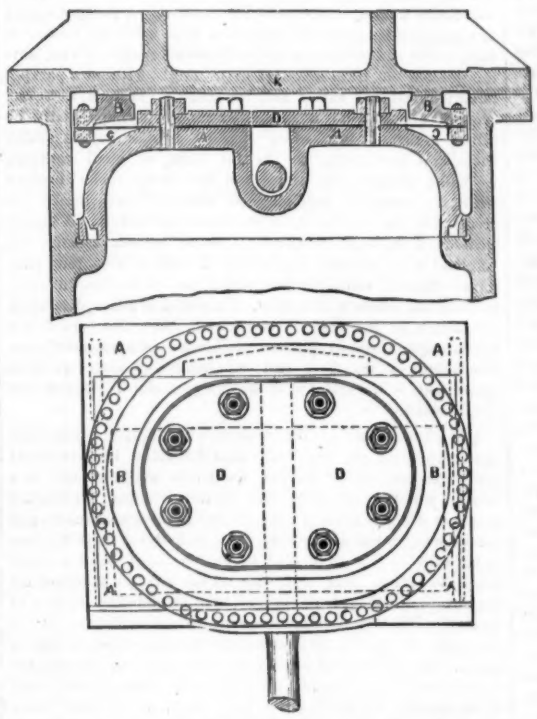
RAILROAD GAZETTE

SATURDAY, APRIL 4, 1874.

Dawes & Holt's Balanced Valve.

The accompanying engraving represents a balanced valve patented by Messrs. Dawes & Holt, and is taken from the *Chronique de l'Industrie*, published in Brussels, Belgium.

A thin plate of steel, *C*, is riveted to the ring *B* which makes a tight joint with the steam-chest cover *K*. The joint-plate *D*, attached to the valve *A* by bolts, keeps this diaphragm in position. Small holes through the bolts communicating with the steam space prevent any accumulation of pressure within the ring *B*. The diaphragm, or steel plate, once placed, is sprung downward about 1¼ millimeters, which keeps the lower face of the valve tight, while its elasticity is sufficient to allow any water which may come from the cylinder to escape. The advantage claimed for this arrangement is that while the joint between the valve and the ring *B* is fixed, it remains perfectly tight during the movement of the valve, while the ordinary joints always leak more or less. Much care is required in the construction of these valves, but it is claimed that when the wearing surfaces are well adjusted they will work for years without alteration, owing to the absence of pressure and the small amount of power required to move the valve. A number of these valves are in use and have given much satisfaction.



DAWES & HOLT'S BALANCED VALVE.

Contributions.

"Eliminating the Error in Leveling from Want of Perpendicularity of the Rod."

TO THE EDITOR OF THE RAILROAD GAZETTE:

I see in your issue of March 28 several articles called forth by one of mine in a previous number, entitled "Eliminating the Error in Leveling from Want of Perpendicularity of the Rod."

The writer of the first of these articles seems to be "drawing upon his imagination for his facts and upon his memory for his jokes." The method of leveling which he attributes to me is certainly ridiculous enough, but unfortunately has no other origin than his own fertile brain. He seems to imagine that I attempt to correct the readings of the rod by the formula given. On the contrary, however, I only sought to find out what reading of the rod was *least* liable to error from want of perpendicularity, and then in practice, as far as circumstances will allow, endeavor to avoid readings very much greater or very much less than that obtained from the formula.

When using the Boston rod I endeavor to keep my readings not far from three or four feet.

Speaking of getting the *shortest rod*, your correspondent says: "No good leveler fails to do this." Now, allow me to say that the *shortest rod* is almost always the wrong one.

With some rods the error involved is not serious, but with others it would be so large as to make accurate leveling impossible.

Suppose your correspondent is using the Boston rod, in which the face of the target is at a distance of 1¾ inches from the center line of the rod. The *shortest rod* will be obtained, *not when the rod is vertical*, but when the line from the face of the target to the point of support is vertical. In case the *true* reading was one foot, he, taking the *shortest rod*, would have (as a little calculation will show) his rod at an angle of 8° 17′ to the vertical, and would obtain a reading of 0′.969, thus making at a single sight an error of 0′.031.

In the kind of leveling in which your correspondent obtained his experience such results may be regarded as consistent with "perfect accuracy," but I need not tell you that in really accurate leveling, when it is necessary to run a distance of a mile with 3-1000 or 2-1000 of a foot as the limit of final error allowable, such discrepancies are not to be thought of.

English versus American Bridges.

TO THE EDITOR OF THE RAILROAD GAZETTE.

In your journal of January 10, in an article on The International Bridge, you say: "It may be interesting to examine why it is that the Canadians prefer the American system of iron bridge-building to that employed in England and her Asiatic colonies."

The reasons which you then proceed to give for the preference may be summed up as follows:

The American bridges are lighter, and not only so save in material but involve less cost for transport.

The lightness is partly the result of the superior quality of the American iron.

The exactness in manufacture, the pin system of connections, the machining, and general finish of the parts of American bridges allow greater facilities for erection than is possible in English bridges, which as riveted structures require more expensive staging and riveting at the site.

As English bridges are sold by the *ton*, the manufacturers are interested in giving as much weight as possible, while in America the bridges are sold per *span*, and it is, therefore, the interest of the manufacturer to economise. It is further stated in your article that as the same proportion of strength to strain is allowed for in the American as in the English bridges, the comparisons you give are fair ones. The superiority of American systems being thus assumed, your article anticipates that they will gradually be adopted all over the world.

As an English bridge-builder, I beg, with your permission, to take some exception to the above statements, partly to what are given as facts, and partly to the inferences which are drawn. I do this at some length, because the comparisons you make have been often made before, and it must have become a matter of astonishment in America, why, after having been told so often, we don't see the folly of our system and imitate yours.

I would, however, premise that we are not blind to certain merits in American bridges, and may acknowledge that while in English opinion American engineers go ahead too fast and draw too great conclusions from slight experience of facts, we here perhaps carry our conservatism to too extreme a point. This will perhaps ever be so, but I should be glad if I could even in ever so small a degree help towards our arriving at a happy mean.

Before anyone on your side of the water can justly compare your systems with ours, he should have before him structures designed by our leading engineers, and should be careful not to accept too readily as English types bridges of second-rate men who as general railway engineers have not paid too close an attention to iron work.

Your article assumes throughout that lightness is in itself a great advantage, but except in the case of long spans it is not so considered by most English engineers. Putting out of question for a moment the cost, a heavy bridge will be less affected by traffic than a light one, and will endure longer; it is therefore for the engineer to consider in *each* case whether economy in the cost of material, exigencies of transport or erection require a structure especially light. Owing to the short distances and facilities for transport in this country no great saving can be effected by adopting a very light system of construction, and the same may be said to a large extent about bridges for export; as freight by sea from England to almost all parts of the world is very cheap. For example, iron bridge work can be conveyed from London to Calcutta for 25 shillings per ton (this is partly owing to the utility of the iron work as ballast or "dead weight" cargo, and partly to the excess of eastward-bound ships, because the ships' profit consists principally in the homeward freight of colonial produce.) There are of course cases when bridges have to be conveyed long distances up country from the port of arrival, and in preparing designs for these places, English engineers, like those in America, appreciate the advantages of making the individual pieces of moderate size and weight, easy to connect, and in keeping as low as possible the total weight.

The difference in the cost of iron in England and America also considerably affects the question. At the present time (March, 1874), the average price for bars and plates as used in structures is about £14 per ton, and for pig iron about £5 10s. per ton; and as these prices are much lower than those in America, there is not the same inducement with us as with you to save in weight. The quality of material here is not—so far as I am informed concerning American iron—quite so high as with you, but you can judge this better from the following figures: The breaking strain for English plates varies from 20 to 22 tons per square inch, and for bars, ties and angle-irons 20 to 24 tons. The elasticity and ductility of the iron is measured by the reduction in area which has taken place at the point of fracture when the iron has been stretched to breaking, and this reduction is, for plates, from 10 to 15 per cent. on the original area, and from 15 to 25 per cent. for bars. The above figures embrace those which are specified by our different engineers. Better iron is made for boilers and other special purposes, but it is found cheaper and generally more advantageous to use for bridges iron of a fairly good quality, which is to be obtained in the open market, than to demand a special quality which is supplied but by few makers and therefore at a more than proportionate cost. In this respect of quality you have an advantage over us, but as I have already shown, circumstances here do not make the question of lightness so important as with you.

In the case of long spans, say over 120 feet, where the weight of the structure itself is great in proportion to the moving load, and is the chief item in the calculation of strains the conditions are entirely different, and the employment of a high quality iron or even steel becomes a matter of the greatest importance. This is duly recognized by engineers here, but the opportunities for showing it are rarer with us than with you, as we have not so often to span great rivers; but the genius of American engineers in this respect is fully acknowledged, and some of your largest bridges are among English bridge-builders' objects of admiration.

But it will be said with truth that apart altogether from any saving in weight which may be effected by using high quality iron, the American bridges are by reason of their design much lighter than English bridges. This is doubtless the case, but they are lighter for the following reasons: The employment of cast iron in parts under compression; the great depth of the girders in proportion to their length; by the facility which the use of the pin joints allows of obtaining from the various members the effective use of their entire area, with deduction for rivet holes; by the omission in many American bridges of platforms and parapets; and finally, the greater margin of safety which it is usual to give in England.

With regard to the employment of cast iron, there is in England, I acknowledge, an excessive unwillingness to employ it, and it is very seldom used by English engineers in wrought-iron girders. The inconvenience in making connections with wrought-iron members, especially with riveted wrought iron, the fear that there may be hidden flaws in the casting, and the insufficient appreciation of the elasticity of cast iron, are the principal reasons for not using it; but it is used here occasionally, and I have myself been concerned in the manufacture not only of wrought-iron girders with the upper flanges of cast-iron tubes, but of wrought-iron roof trusses with rafters so made. When compression members of tubular form which are inaccessible for painting are employed, I consider that cast iron is better than wrought iron, not only because of its greater strength against compression, but because of its less liability to rust, and because the greater thickness that is given to the individual parts of cast iron as compared with wrought iron affords a greater margin for wasting away by rust. Of the great importance to be attached to this question of rust, I speak further on. But it is questionable whether in America the use of cast iron is not carried to excess, by its employment sometimes in compression members whose length may make them dangerous and liable to fracture in case of accident.

With regard to the depth of girders, the proportions most common in England are from one-ninth to one-twelfth of the span. But English engineers do not require to be told that the strains in the flanges can be reduced and lightness of construction obtained by making girders much deeper. Brunel, the English engineer and man of genius, made very deep girders thirty years ago, and his bridges at Chepstow and Saltash remain to show his powers of design. In long spans the depth of the girders is limited mainly by the expense of stiffening laterally. Whether that stiffness is obtained by wide flanges, by gusset or bracket connections to the cross girders, by bracing across the bridge above the roadway, by stiffening the struts, or by a combination of these methods, the cost of doing it increases rapidly with the depth of the girder. Unlike a tie, the strength of whose sectional area is unaffected by the length, the capacity of a strut to resist compression diminishes rapidly as its length increases, and in deep girders a strut requires such an amount of stiffening and bracing, to enable it to transmit the strain, as to counter-balance very materially by its cost the economy otherwise obtained by the depth of the girder. Even in girders of long span it is probable that English engineers would consider greater and therefore more expensive precautions necessary than would American engineers. But subject to this and to the effect it would have on the saving to be obtained by using deep girders, there would probably be little difference between the designs that would be made by English and by American engineers for railway spans of 120 feet and upwards. The difference would not certainly exhibit any want of skill among English engineers, but probably the greater margin of safety which they would deem it necessary to give. It is, however, in short span bridges that the difference between our systems and yours are most manifest. By using girders with a depth of one in five, or even one in seven, for spans from 30 feet to 100 feet, the weight of the structure is kept very low in proportion to the moving load, and for that reason is considered unsuited for *permanent endurance* under severe railroad traffic. Very light bridges receive a blow almost as with a hammer when a heavy train passes over them, and a considerable amount of anchorage is necessary to prevent them jumping as the train leaves them. If to still further lighten short-span girders they are made deeper, not only is the proportion of dead load to running load reduced, but in many cases the individual parts are also reduced in thickness and strength. There is then in like proportion a less margin for deterioration by rust, and generally a shorter life. In first cost the American bridge is cheaper, but when the cost of maintenance and renewal is considered, the English bridge is ultimately the safest and the cheapest too. The light truss bridges which are illustrated in your advertising columns every week, and which apparently are offered for ordinary purposes, and for sites offering no special difficulties in erection, do not find admirers or imitators here, for the above reasons.

The relative advantages of the pin system over that of riv-

cted connections have been frequently discussed here, and English engineers differ in opinion respecting them. In bridges designed and made in England for places in India, Australia, South America and other countries where skilled labor for erection is unobtainable, or where, because of the lack of supervision, there is a risk that the riveting at the site may be carelessly or badly effected, or where staging for riveting would be very expensive, pin joints are almost universally preferred. With them it is of course necessary that the greatest exactness shall be observed. Holes are bored out and pins are turned to gauges that not only shall the pins all fit tightly, but so that in many spans all similar parts are interchangeable. For instance, in pins of 4 in. diameter a margin of 1-100th in. in the hole would be considered ample. As these precautions are observed equally in England and America, it is needless to say more about them, but the superiority in regard to the machining of the parts and exactness of finish in American bridges, which your article assumes, is a mistake, because just the same processes are used here when the design is of a nature to require them. Even in plain riveted girders all butting joints are planed and rivet-holes made with the greatest accuracy. There are, of course, many arguments in favor of pin connections. In a comparatively new country, like America, it is possible to use the same type of bridge and even the same length of span so frequently as to permit great repetition in the manufacture of the parts, and the employment of machinery becomes economical. But in England, where a new railroad passes through a thickly inhabited country where there are existing roads, streets, canals and railroads to be crossed, every bridge has to be considered, and the parts of one can hardly ever be made similar to those of another. It is obvious, therefore, that a system which may be cheap when applied to numerous similar bridges may prove very expensive where no two bridges can be made alike. There are, of course, other advantages which tell in favor of pin connections. Not only do they offer facilities in the erection of a bridge, but they as hinged joints transmit the strain centrally under all conditions of the structure. I have already said that in large spans and under peculiar circumstances of erection these arguments are generally allowed to prevail here, but for ordinary cases riveted joints properly designed are preferred. Doubtless the group of rivets joining the connection demand greater skill and care in the arrangement than is necessary with a pin joint, but it is considered that this skill and care are repaid by the result. It is possible that in America badly riveted work is in the minds of those who assert so strongly the superiority of the pin system, and badly riveted girders are made in England as elsewhere when cheapness is the only consideration and no proper supervision is exercised. It is needless to discuss here the relative advantages of drilled and punched rivet-holes, because apart altogether from the question of cost, there are great differences of opinion on the subject, though the best informed bridge-builders here are gradually coming to the agreement that punched holes are the best. As I have already stated, pin connections are frequently used by English engineers, but their use is confined almost entirely to cases where a large diameter, say not less than 4 inches is needed, and where the strain is always in one direction. There are many objections to the pin system altogether as compared with riveted connections, and these may be stated as follows: However tightly pins may fit in their holes, there is never that perfect and permanent contact of surface which is obtained by riveting properly effected. Under railroad traffic, a hammering of the pins in their holes sooner or later takes place, especially where the member held by the pin is alternatively in tension and compression. When the shaking or hammering of the pins begins, the destruction of the bridge has commenced. This evil is specially serious in small, light bridges, or in bridges where numerous light or minor parts are held by screwed pins and nuts. After a few years of traffic, the bridge will be heard to rattle as a train passes over it, and this is a sign that the fastenings are becoming loose and inefficient. The Fink trusses, and others of the same character, which are made in America for railroad bridges of small span, would not, in the interest of public safety, be allowed by the Government Inspectors in this country. In the well-known English bridge known as the Crumlin Viaduct (10 spans of 150 feet, with girders 15 feet 6 inches deep) the connections were made with pins; but it has been found necessary to remove the pins and to substitute riveted gussets. Struts connected to the main flanges by groups of rivets are stiffer to resist bending sideways than are struts held only by hinged pin joints.

Railroad bridges, and, indeed, iron structures of all kinds, are comparatively so new in the world that there is as yet no sufficient experience of the decay which is produced by rust. It is highly probable that the coming generation of bridge-builders will have much to do in replacing the structures of the present day. Bridges are too often made with some of their parts inaccessible to the painter's brush, and painting, even when possible, is often neglected. A riveted girder, properly designed, can be painted all over at any time. Rivets, properly inserted, are unassailable by rust, as the contact of surfaces where the rivet fills the hole is so perfect as to prevent oxidation from commencing. Not only, however, on the shaft of the rivet, but under the rivet-heads, the iron will be found quite bright and free from rust after many years of service, if the workmanship has been as it should be in the first instance. Pin connections are not thus protected. However well and truly the nuts and washers may have been machined, it is all but impossible to keep the surfaces air-tight, and a moist atmosphere engenders rust; and even if when first erected the nuts and washers fit closely, sooner or later, the percussive action of the trains will shake loose some of the nuts and allow the commencement of rust. The rust eats into the iron and has its destructive powers seconded by the constant tremor of the bridge under traffic. Where a bridge is composed entirely of such connections, the risk of one part failing is, of course, great in proportion. If in a certain number of years rust has diminished the thickness of an iron plate 1-16th inch, it is obvious that while the light plates or bars ¼ inch thick will have lost 25 per cent. of their strength, the thick plate 1 inch thick will have lost only 6¼ per cent. This is another argument against very light structures, where the surface exposed to the atmosphere is great in proportion to their weight or to the thickness of their separate parts, but the argument tells only in the minds of those engineers who look ahead to the future of their structures.

Your article lays some stress on the fact that in England bridges are sold by the ton, so that it is the interest of the manufacturers to give as much weight as possible, while in America the bridges are sold by the *span*, and it is therefore the interest of the manufacturers to economize. In England the greater number of bridges are not designed by those who make them, but by professional engineers who do the best for their employers. Whether their employers be railway companies or private individuals, they are alike averse to spending more money than necessary, and in the competition of the designing engineers there are as great incentives to economy as in America. Having decided on the design, the price is asked for per ton from the manufacturers, merely as a convenient standard for comparing their prices.

The real comparison between different systems or different designs is as with you made by comparing the total cost per span. Some of the leading bridge manufacturers in England do design their own structures, but in these cases their prices are, as with you, judged according to the cost per *span*. In the opinion of some of us here, the offer of a price *per span* to a bridge-builder is an inducement to him to exercise such an ingenuity in the design as may, while tending to a low first cost, be also prejudicial to the permanence of the structure.

It cannot be denied that economy is obtained in America by making skeleton bridges without parapets or floors. A parapet serves to some extent as a protection for carriages which may have left the rails. Brunel was most particular in so protecting his bridges. A case occurred in England only about a year ago where a train which had left the rails on a bridge was saved from destruction by the parapet. A parapet serves as a handrail for railroad employees who cross the bridge on foot, and it is a protection to passengers or others who, having quitted the train in a dark night, might without a parapet fall into a river or valley and be killed. Parapets, however, are not essential to a bridge, and may, perhaps, justly be called luxuries. Still, while English bridge buyers prefer them, and are willing to pay for them, we shall continue to make them; but as we can as easily make bridges without parapets, economy so obtained can hardly be credited to the superiority of the American system. A bridge without a floor is, however, a more serious matter. In England it is generally the custom to make a complete platform, either of timber or iron plates, and then, most usually, to cover the whole with ballast. If a collision takes place upon the bridge, or the train leaves the rails there, the cars do not fall through, a catastrophe not unknown on American bridges. The weight of the floor and the ballast, especially in short spans, adds to the stability of the bridge under the action of a moving load.

A full exposition of the reasons why English bridges are more expensive (in first cost) than American bridges would involve an analysis of English traditions and instincts in a manner which would affect other matters besides. An English engineer designs his iron bridges, like he does his tunnels and earthworks, to last a very long time; in America there appears to be a desire (I shall be glad to be convinced that I am mistaken) to save in first cost, without too anxious a regard for the future. A deep truss bridge, with an elaborate system of tie-rods, pins, and nuts is designed, and the sufficiency of its strength is proved to demonstration most satisfactorily on paper. The theoretical strains are confirmed by the manner in which the bridge stands the test load; owing to the depth of the girders, the deflection is very small, and nothing more is apparently to be desired; the manufacturer who sold it at so much per *span* gets his money and has done with it. But will that bridge withstand a sudden shock, and exceptionally heavy or unequal load like an English bridge, and is it as likely, after 20 years of railroad life and incident to exhibit such a good condition and fitness for the future? These are the points which are uppermost in the minds of bridge designers and builders in this country; and as sufficient time has not yet elapsed to prove the endurance of your bridges as compared with ours, the question must yet for a few more years remain undecided by facts.

Shareholders in English railroads are as keen after dividends as are the shareholders anywhere else, and they put all the pressure they can on directors and engineers to economize. But we have very stringent laws, and every sufferer by a railroad accident is entitled to a compensation, which is measured by a sympathetic jury, who themselves are liable to railroad accidents. The damages they award are so heavy as seriously to diminish the dividends of unfortunate years, and if the responsibility for the accident can be fixed on any official, his life is made unpleasant to him. Whether the laws in America tell with equal force in this respect, I as an Englishman am unaware. Collisions and other accidents, which no foresight by the engineers can prevent, occur in England as elsewhere, and our newspapers like yours have plenty of ghastly incidents to fill their columns. But it may surprise your American readers to hear that our railroad bridges never give way. Certainly it is no exaggeration to say that not one accident per annum happens from any failure of a railroad bridge, while in the columns of the RAILROAD GAZETTE the tabulated statements of American catastrophes show a regular proportion of bridge accidents. In your journal of a few weeks ago, where you give a summary of the railroad accidents for the year 1873, I notice 19 cases of bridges giving way. I presume some of these were iron bridges. So long as this is the case, no asserted superiority of American systems will induce us to adopt them here in their entirety; and, speaking generally, the most eminent continental engineers appear by their practice to hold similar views to ours.

It is true that in South America, Japan and other of our foreign markets the strict laws about compensation do not follow us. But we have got so into the habit in England of making bridges for permanent endurance that we cannot get out of our old-fashioned grooves all at once. An English engineer or bridge-builder would be shocked and consider his reputation to have permanently suffered if his name were associated with the failure of a bridge. Still, by the time that American bridge-builders are supplanting us everywhere in foreign countries—a consummation which your article of January 10 predicts—we also may possible have become affected by the spirit of the age and make bridges with the one consideration—that they will sell.

Apologizing for taking up so much of your valuable space, I remain, sir, Yours faithfully, EWING MATHESON.

What may be Gained by Experiment and Close Observation—115 Unexplained Derailments Partially Accounted for—Results of Neglecting Small Matters.

It would be interesting and, no doubt, profitable to know just how much money has been thrown away in the aggregate by the railroads in this country, within the last thirty years, for worthless patents, and by the wholesale adoption of so-called improvements that were not patented. There is hardly a road in the country that has not been injured by going blindly into improvements by which they have been losers in sums varying from a few hundreds to many thousands of dollars. These losses have resulted from the purchase of invalid patents and infringements, and from the utter failure of the alleged improvements to meet their expectations. Losses from the former cause may be guarded against by paying a competent patent attorney a fee of five dollars to search the records of the Patent Office. A guaranty from further losses from worthless contrivances may be found in a thorough test by actual experiment before making a large outlay. There is something unaccountable in the almost universal reluctance on the part of railroad managers to try experiments, and the consequence is they lose a few thousand dollars on some worthless concern, after which they look upon all new contrivances as a humbug, and as a further consequence they cheat themselves out of the use of some inventions of real merit. As a rule, it is unsafe to judge of the merits of any new device from appearances. Those who went heavy on the "compound" or "endless" rail can certify to the truth of this, and there are several new inventions of a kindred nature now before the public that are—as the bank-note reporters say—"well calculated to deceive." In the case of the endless rail, it *appeared* to be perfect in every respect, and the confidence in its superiority was so great that all roads under construction besieged the mills for that rail, and completed roads that could get hold of enough to relay their bridges with were considered fortunate. The boy of the period is not more pleased with the latest thing in skates than were the C. E.'s, L. E.'s and R.M.'s with their endless rail. But it soon became apparent that these men were the victims of misplaced confidence, and the stockholders foamed thereat. For a short time this rail performed all it promised to, and it relieved bridges from much of the strain and vibration incident to the use of the ordinary rail; but it soon came to pass that, as the rail was put together with hot rivets, there was no room for contraction of the rivet or expansion of the rail. Thus there was a constant struggle between the two halves of the rail for a dissolution, which was hastened by the destructive vibration of passing trains. Rivets would break at the ends of the inner half of the rail when some wheel-flange would follow the "split," tearing the rail asunder, which usually resulted in a derailment, the cause of which could be readily explained. The life of the compound rail was short, but during its brief existence it shortened the lives of quite a number of persons, and made the purses of several railroad companies tolerably short. The most natural conclusion that can be arrived at after a mature consideration of the fate of the endless rail, is that it is best to handle all combination rails carefully. There are, however, some newly-invented combination rails that seem to be worthy of the consideration of all railroad managers. If a rail can be produced that will carry the traffic of our greatest routes safely and only cost one-half as much as the rails now in use, it is certainly worth looking after, and there are rails now in the field for which all this and even more is claimed. Inventors of combination rails, however, should bear in mind that the same weight of rolling stock that crushes the "life" out of *solid* T rails will not pass harmlessly over a rail of any other construction, as some seem to suppose. The question of durability can only be decided by actual test, and those roads that will require renewal of rails at no distant day should have a piece of track laid with some of the new rails of sufficient length to give them a thorough trial. And companies laying new track with the T rail have an excellent opportunity for testing the durability of compound rails as compared with the T rail. This can be done at a trifling expense and with very little trouble. In this there is no chance for loss, with a fair prospect of a great gain, especially if the rail selected for trial is of the most approved construction. Although there a thousand and one patents on improvements in permanent way, there are but few of sufficient merit to entitle them to any consideration whatever, and although the best of those few certainly give promise of much good in the future, it is not best to lay a hundred miles of track with any of them until they are PROVED.

It is not to be expected that a railroad officer will turn his office into a chemical laboratory and rack his brain in search of scientific discoveries, although it might enable him to

determine which is the most valuable of the lubricating compounds in the market, and he might learn something of warming and ventilation, &c., &c. But this field, although an important one, properly belongs to other than active managing officers, as their duties are such as to preclude the possibility of their conducting elaborate scientific experiments.

It is by close observation and impartial trial of new devices designed for the improvement of permanent way and rolling stock that an out-door manager of railroad affairs can make experiment or investigation profitable to the company. Compound rails, nut locks, or any of the joint fastenings and rail splices, safety switches, car couplings, brakes, signals and all appliances, stationary or movable, designed to promote safety and economy, can be placed on trial, and officers and employees can notice and report all defects and favorable points at head-quarters without seriously interfering with their regular duties. It may be well, in this connection, to caution the "power on the throne" that what employees say of new contrivances placed in their care for trial is not always trustworthy. In this respect railway operatives stand in their own light after the manner of chief managers; that is, if they do not fall in love with any new device at first sight, they never see any good in it afterward, and their aim is to persuade "the old man" to get rid of it as soon as possible. They do not understand that these appliances, while they may in some manner save money for the company, will at the same time lighten their load of care and labor, and keep them from harm. They look upon these things as the school-boy does at fractions, of no earthly use but to bother and perplex, and they would have them "ruled out." But they think better of them when they have mastered them and can see their good points.

And, aside from what benefit may be derived from a fair test and final adoption of what may prove valuable in the line of new improvements, much valuable information may be gained by a close observation and inquiry into the *causes* of every-day occurrences. Train-men have frequent opportunities of exercising and developing their organs of causality, but they seldom improve those opportunities. They find themselves and their train in the ditch, and they give no thought of what caused the mischief, but they give their whole attention to ways and means of getting out of the muss. It sometimes happens that in the course of putting things to rights, the cause of the trouble comes to light, but in many cases of derailment nothing is known of what brought it about. Perhaps it would not be out of place here to give the RAILROAD GAZETTE report of "Train Accidents in 1873" a slight overhauling, and with the Editor's permission we will proceed to take a few lessons therefrom.

In the first place there were 315 unexplained derailments in that year. Now theoretically no car or locomotive should ever leave the track without some failure or defect in the car or locomotive or some misplaced switch or obstruction or defect or failure of the track. The rail has been formed by skillful mechanics on scientific and mechanical principles for the sole purpose of giving *a safe way* for railroad cars, which cars were also especially designed to run *on the way* especially prepared for them. The form of the rail and the wheel flanges are such as to preclude the possibility of any car running off the track when both track and cars are in perfect order—obstructions being counted as track out of order.

But assuming that these 315 derailments for which no cause is assigned occurred without any derangement of way or cars, we shall be obliged to acknowledge that theory is pretty thin in railroad practice. But if we go further, and dig a little below the surface we may find something wrong in practice that will explain much of the mystery. Doubtless the manner in which cars are loaded has much to do with their leaving the track. Cars are frequently loaded with heavy machinery, blocks of granite and freight of a like nature, and one corner of the car bears most of the burden, which leaves the weight outside of the line of draft. For convenience of illustration, let us suppose a platform car to go west with a heavy piece of machinery resting principally on its right forward corner. When the car encounters a curve to the left, the right forward wheel flanges would be thrown against the outer rail of the curve with undue force, when if there were any defects in the track, such as a slivered rail, imperfect joint or track out of surface or line, it would be very likely to jump the track on the right side. And the defect in the track might not of itself be sufficient to cause trouble, but the improper loading of the car creates a constant effort on the part of the car to leave the track, which it will do on the slightest provocation. If we remove the load to near the left forward corner of the car, on the same curve, and all other circumstances the same, no derailment would be likely to occur, as the weight would be nearer the line of draft, and the flanges would not be carried against the outer rail with sufficient force to cause them to mount. So if we should change the load to either of the rear corners of the car we should increase or decrease the liability to derailment according as we change the relation of the car and its load in its relation to the curve and the defect in the track. By defects in the track no reference is had here to broken or slivered rails, or anything that would be regarded as unsafe at a glance, but minor defects that would scarcely attract the attention of a cheap track-man, such—for instance—as a low joint on one side of the track when the opposite one is up to a good surface, and the same joint slightly out of line. The same joint may be either wide or narrow of its gauge ⅛ or ¾ of an inch (a very common defect), and all of these combined are sufficient to cause any number of unexplained derailments. A sound rail laying on a reasonable number of sound ties and well spiked may *appear* to be perfectly safe to the casual observer and yet contain all the elements of mischief, especially when aided by some slight defect in cars or locomotive—a worn flange for instance. The great number of derailments for which there is no apparent cause points unmistakably to the importance of aiming at absolute perfection in permanent way, and to the fact that a combination of minor defects frequently causes disasters equal in magnitude to those for which a cause is readily assigned. The following may explain *how* slight defects may cause disaster:

First, A joint out of line will cause excessive "end-thrust" (of the axle) producing a powerful friction of the wheel-flange on the rail, causing it to "bite" and climb. This may occur on a perfectly sound rail, but of course the liability to mount would be increased if the rail was somewhat worn or flattened at the joint, and trucks *in good order* might pass that joint for years without accident, but there is a defective wheel somewhere that is bound to unite with the rail and ditch a train.

Second, A joint may be ⅛ or ¾ of an inch wide of its gauge, which would also leave the way clear for a powerful end-thrust, with results as above.

Third, A joint may be ⅛ or ¾ of an inch too narrow in the gauge, which would cause a flange friction sufficient to throw the flange over the rail. And in addition to the mischief that may result from either a too wide or too narrow gauge, is what may occur from the track being out of line, as it is obvious that either of the two defects would throw at least one side of the track out of line, so that in this case (a common one) we find that *with one defect another is inevitable*, making a combination which is very likely to be made still more complicated by the addition of a defective wheel or truck.

Fourth, The flattening of the ends of the rails, which increases their width, thereby narrowing the gauge, producing abrasion by the flanges on both sides of the track, might not of itself throw a flange over the rail for years, but the absence of some or all of the fish bolts and bars, or any defect in the joint fastening, (very common), will allow the wheel flange to push the end of one rail out of place in its relation to the connecting rail, leaving the end of the further rail exposed sufficiently for a worn flange to climb.

Fifth, Improper loading of cars, by which the weight on the trucks is unequally distributed and thrown too far from the line of draft on either side, (of course it will change as the curves change), may be a sufficient cause for derailment of itself, but in addition to any or all of the abovementioned or other defects would be tolerably certain to cause disaster.

Sixth, It is possible to throw a car off the track when both the track and car are in perfect order. This has occurred on many occasions in the experience of the writer, and was the result of hauling an empty car at or near the middle of a long and heavily-loaded train. In such cases the car leaves the track on (or from) the the inner side of a curve and on an ascending grade. On a descending grade the car leaves on the outer side of a curve, but this is more likely to occur when the light car is running well forward in the train. *Several* empty cars running in this way greatly increase the chances for a run off, and if there is one among them (the empty cars) that is loaded in the manner above mentioned, there is a strong probability of an unexplained derailment.

The reason for the empty cars being "pulled" off the track on an up grade is that the strain on them required to draw the cars that are behind them pulls the wheel flanges against the inner rail of the curve with great force, and the peculiar rolling friction throws the flange over the rail, there not being sufficient weight on the car to hold it down.

On a descending grade if some of the forward brakes are set the rear portion of the train crowds the flanges against the outer rail and over it into the ditch.

Seventh. And it is holding heavy trains on curves and descending grades that has thrown more locomotives from the track than any other cause. Insufficient brake power at the rear of the train is a fruitful source of mischief, by reason of the force of a few hundred tons crowding a forward car on which a brake is set, or the locomotive when holding the whole train becoming cramped and uneasy in that position, and leaves the track for relief. "I don't know what got me off the track, we were running very slow," is the usual remark in such cases; and it was the *running slow* that caused the trouble, or rather the powerful effort of the locomotive to not run at all.

All these (and perhaps more) are causes of derailment, and they are really more perplexing to the railroad operatives and managers than breakages or any of the causes that are plain to be seen, as the latter may be guarded against or prevented to some extent in the future, while the former causes are more treacherous and slippery, and cannot be handled with any degree of certainty. It would be unreasonable to suppose that all accidents of this class can be prevented even by the exercise of greater care and vigilance than generally disturbs the quiet brain of railroad operatives, but to say that some millions of dollars worth of them may be prevented is not putting it too strong. We cannot expect that degree of perfection in permanent way which is necessary for absolute safety, but there is no excuse for a great many of the imperfections which, although slight in their power for evil singly, become powerful agents of destruction when acting in concert, so to speak, with other *seemingly harmless defects.*

When a rail becomes "slivered" and no sound one can be had to replace it, it can be changed "end for end," the sound side brought to the flange, or, if on a curve, the rails can change sides, that is, the rail on the inner side of the curve may be placed on the outer side and *vice versa*. A close attention to the joint fastenings, a correction of the variations from a true gauge, and more care than is usually bestowed in keeping the rails in perfect line, will work wonders by way of reducing the repair shop account.

Some good will result from greater care in loading cars, that the weight may be as equally distributed as possible on the wheels, and if train-men would be at some pains to run empty cars at the rear of trains, and distribute their brakemen so that no considerable portion of the loaded cars will be allowed to crowd the forward portion of the train off the track, as above explained, the services of the wrecking train would be less frequently called into requisition. And it is not only the good that would result from attention to these seemingly unimportant details by the mischief it would prevent, but a *habit* of attending to small matters would ensure a more thorough regard for matters of greater importance. *Habits grow*, and the first case of neglect of a trifling affair is as sure to lead to habitual carelessness and recklessness, as the first cup is to intemperance. Nine lives were lost and 20 or more persons severely injured and some thousands of dollars' worth of property destroyed within a few days of this writing, all of which was the result of neglecting to attach the bell-cord to the bell in the cab. This, of itself, was a very small matter, but it was as terrible in results as would have been the neglect of the managers to have furnished a bell-cord or even a bell, and this the public would call *criminal neglect*. And it seems the company were open to this charge by not equipping the car (which was burned) with an extinguisher. It would have been commendable on the part of the managers had they provided an extinguisher, but the same habit of neglect, indifference or stupidity that rendered the bell cord useless would have failed to put the extinguisher to use. At least there is good reason to suppose that would have been the case, as there was no presence of mind exhibited on this occasion and there is nothing better in a railroad accident, unless it be absence of body. Here the bodies were present, but the presence of mind was absent, or some one would have quietly uncoupled the burning car and set the brake, when all could have left the car unharmed. This could have been done and time to spare when the fire was confined to the saloon, but no one seemed to remember that brakes were for use in case of accident. But there is always a great deal of useless talk concerning what *should* have been done on such occasions, and this may be some of it, but it is only mentioned here as a fresh instance of what frequently results from *a combination of something wrong in a small way*. What the *primary* cause of this disaster was is not reported, but it is supposed to have resulted from a dangerous and defective manner of lighting the saloon, making a still longer list of small matters neglected. But, assuming that the fire originated from causes beyond the control of any one, and that it was a *genuine accident*, the fire was no more the cause of the catastrophe than was the neglect to atttach the cord to the bell, or to uncouple the car and set the brake. These were there, and it was the duty of some one to use them, and a verdict that these people came to their death by habitual neglect of small matters would perhaps be as comprehensive as any that could be rendered. It is not the operatives alone who are afflicted with these habits of indifference, but the owners and managers are subject to the disease in its worst forms, for it is their neglect to provide appliances for safety and enforce strict attention to duty that leads their employees to habits of recklessness and criminal neglect. Three hundred and fifteen unexplained derailments in one year makes a smutty record, and there is no surer way of making a brighter one for the next annual report than by acting on the foregoing hints.

WILLIAM S. HUNTINGTON.

Distance Indicators.

BOSTON, Mass., March 16, 1874.

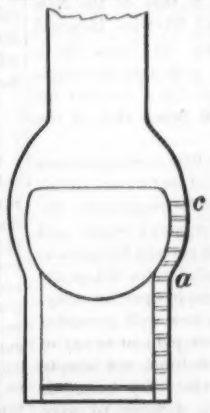
TO THE EDITOR OF THE RAILROAD GAZETTE:

Upon the subject of telegraph poles, I may say that on the Eastern Division of the Boston & Albany Railroad we use them as distance indicators with success. The poles are set very uniformly 40 to the mile, so that they average 132 feet apart. The mile posts are substantial stones, well marked on two faces, and set on each side of the tracks. With these points we indicate a culvert, bridge, road crossing, etc., as being 14-28 for example—that is, 28 telegraph poles beyond the 14th mile stone, or nearly 14⅞ miles from the Boston depot. G. R. H.

Broken Stay Bolts.

Mr. W. S. Ayres, of South Easton, Pa., contributes the following to the *Engineering and Mining Journal*:

"The boiler from which these stay bolts have just been obtained was that of the locomotive Catasauqua, Lehigh Valley Railroad, built at the company's shops, South Easton, Pa., in 1864. The iron is Lowmoor, and has been in use nearly ten years.



"The majority of the broken bolts were found to be along the curve of the shell, from *a* to *c*, and in all cases observed were broken just *inside* the *shell*, and in no case *next* the *fire-box*.

"The iron has become highly crystallized from some cause, and is very brittle, only requiring three blows of an ordinary machinist's hammer to break the sample.

"On the other hand, when annealed it is remarkably *tough*, as shown by the doubled sample herewith presented. All of the fractures seem to have been of slow procedure, beginning at the top of the bolt, gradually working deeper and deeper until the pressure of steam overcame the tenacity of the remaining parts. Unequal contraction and expansion of the parts of the boiler seem in this case to be the only existing cause for a fracture in the stay bolts; and the fact that these fractures begin at the top of the bolt seems to be worthy of notice."

Convicted Conductors.

The trials, at Philadelphia, of former conductors of the Pennsylvania Railroad Company, charged with embezzling moneys received for the company and stealing tickets, have resulted in the conviction of Thomas D. Shreeves of embezzlement, while Samuel Fennimore and Samuel R. Toy pleaded guilty.

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Editorial Announcements.

Addresses.—*Business letters should be addressed and drafts made payable to* THE RAILROAD GAZETTE. *Communications for the attention of the Editors should be addressed* EDITOR RAILROAD GAZETTE.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies, the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and in their management, particulars as to the business of railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

RAILROADS SEIZED BY STRIKERS.

During the past few months there have been several demonstrations by railroad employes, which are in reality acts of war, usually not for an advance of wages or a change in the conditions of their service, but to collect their dues. The first of these was on the New Jersey Southern, where the men, despairing of ever getting their pay, ran the engines to the round-houses, blocked the road, and declared that the road should not be worked until they got their pay. Probably almost every honest man sympathized with these men in their indignation. Not only were their wages in arrears for a long period, but it is quite probable that the managers of the property had made no provision for their payment and kept them in their service with scarcely any expectation of paying them.

The next case that we call to mind is that of the New York & Oswego Midland, which had likewise incurred obligations with a recklessness, to say the least, which was almost criminal; but had already gone into the hands of its creditors, and was being worked by a receiver for their sole benefit, the first lien of all being that of the men.

Last we have the great strike on the Erie at Susquehanna depot, where the men, as a means of enforcing claims which, so far as reported to us, seem to be reasonable, deliberately took possession of the company's shops and trains and put an end to its most important business as deliberately and decidedly as the Confederates did on the Baltimore & Ohio during the war, when in open hostility.

Now it makes no difference what or how well grounded the wrongs were of which the men complained in any of these cases. Their acts were flat rebellion, not simply against the companies in whose service they were, but against the law of the land. It was a defiance to every law-abiding citizen, and the assertion of a right of self-enforcement of personal rights such as would be fatal to all order, the general or even common practice of which would of necessity bring us back to the dark ages, with a fortification on every hill, a large part of the community constantly engaged in actual warfare, and the prevalence of robbery and all crimes under the pretence of and even in the honest effort to secure the observation of personal rights.

In a barbarous society, men have to depend pretty much on the strength of their several arms and the sharpness of their several wits for the enforcement of their rights, whether these be the collection of a debt, or the punishment of inquiries. When Speaking Bear agrees to pay Buffalo Eye two dressed robes and a deer skin for a scalping knife and a pint of whisky which the latter brave has acquired from the trader, Buffalo Eye knows that if his red brother, Speaking Bear, should become angry, or conclude that the bargain was too hard a one, or for any other reason conclude not to keep his bargain, he the creditor will not be likely to get the skins promised unless he can with his own force overcome that dishonest Bear, and cause him to fear something worse than the loss of the peltry in question. There will be no constable, no replevin, no display of the united forces of the tribe to compel Speaking Bear to keep his contract.

One of the first and most essential of the steps from savagery towards civilization is that which takes away from the individual the right to enforce his own rights and which substitutes therefore the united force and authority of the community, which, on proof of a wrong, sets about righting it with the strength and the wealth of the whole nation behind it.

Now while the advantages of the civilized procedure are so great that it would be superfluous to enumerate them, still it must be confessed that there is a promptness about the barbarous system which not unfrequently the most civilized admire and covet. It is vastly more satisfactory, for instance, when your neighbor is caught riding off to market the fine horse which he had just sold to you to be able to arrest him in his course by "drawing a bead on him," and to enforce the fulfilment of the contract then and there with cold lead; or, by seizing his lodge, ponies, squaw, papooses, and other property, induce him to fulfill the promises he has neglected to keep. But in view of the fact that in such a society it is the man with muscle or wit, and not the one with the just claim, who succeeds, civilized communities have united in agreeing that this admirable promptness is too dearly purchased.

The one mistake made by the Erie Company, *after its trains had been seized*, was in treating at all with men who were making actual war upon it. The soldiers cannot be sent for too early when actual hostilities have begun. Probably enough, the company's managers felt that there was so good ground for the complaints, or some of the complaints, of the men, that they would have preferred to excuse their crime even, if it had not become so serious.

The circumstances can hardly be imagined in which men, without the authority of the law, would be justified in seizing their employer's property and stopping his business by violence. It is never necessary for the purpose of securing their claims, for it really adds nothing to their security and does much to lessen the employer's ability to pay. Wisely, the law provides that the workmen have the first lien on railroad property. No mortgage can deprive them of their priority, and so long as the dues to workmen do not exceed the price which the whole railroad property will bring at mortgage sale, their claims are fully secured.

Strikes—the refusal to work unless fair wages and fair treatment are given—may be entirely justifiable; but such acts as these will bring discredit on all engaged in them, and more and more prejudice employers, already too much prejudiced, against the claims of workmen. Imagine a servant girl disconnecting the water and gas, putting the range out of order, and locking up the kitchen, and coolly declaring that there shall be no cooking in that kitchen till she gets her pay, and the right to two "afternoons out" weekly. Even she knows better than that, and if she did not a policeman would soon convince her. So when other employes are similarly ignorant and similarly violent, they must be taught by officers of the law: by those with writs, if the men will obey them, if not, by those with bayonets.

Railroad Men in the Newspapers.

Railroad discussions in the newspapers are usually very one-sided affairs, in which the recklessness with which charges are made is only equaled by the ignorance of railroad business displayed. This ignorance, however, is not always the fault of the writer; for the men who are familiar with railroad business, the railroad men themselves, show a reprehensible tendency to put their lights under bushels, and the conscientious journalist or legislator finds great difficulty in obtaining information on the subject which he is in a manner forced to discuss, or of the opinions which railroad men hold on matters which they are compelled to study. This is all wrong. When an influential newspaper, or a prominent public speaker, gives utterance to an impeachment of railroad management, intended for the public information, in which most of the statements are positively false, and most of the arguments fallacious, as is the case almost daily, railroad men should not let it pass unchallenged. It is true that the public may be disinclined to trust their contradictions; but the writers and speakers at least are likely to learn something and cease in some degree (when they are not utter demagogues) to repeat the statements proved false and the arguments clearly demonstrated to be fallacious. But these wild screeds are scarcely ever contradicted, and the great public, which has no other sources of information, not unnaturally suppose these uncontradicted statements to be unanswered because they are unanswerable.

Recently there have been instances of railroad managers taking part in discussions; and these, it seem to us, deserve to be encouraged and imitated. Indeed, in these days a popular defence of a railroad's policy may often be a duty of its managers, as it may be essential to the preservation of the property to its proprietors, or at least some of their rights in their property. We have heretofore noted Mr. James F. Joy's series of letters to the Detroit papers on the bridge question, and have copied other utterances of his, directed to sundry parties on sundry subjects pertaining to railroads, which will doubtless have much weight. Mr. J. W. Bishop, General Manager of the St. Paul & Sioux City and Sioux City & St. Paul roads, has contributed several letters which give facts and logic which should forever put an end to much of the loose talk in that State. For instance, in a circular addressed to the Minnesota Legislature, he showed from the official reports of the State that the average net earnings per mile of the mileage worked in the State for three years had been $697.93 in 1870–71, $366.87 in 1871–72, and $661.97 in 1872–73, the average having been but $566.12, which is at about 2 per cent. on the average cash cost of the roads as the Railroad Commissioner estimated it, which is not half of the average capital account. He gives the figures for his own roads and makes it plain to the humblest capacity that they are making far too little money, instead of too much. Another letter of Mr. Bishop's was in correction of a statement of the cost of running freight trains made in a debate of the Legislature. This statement made it out to be 24 cents per train mile, while Mr. Bishop showed by the Railroad Commissioners' Report that the actual cost on Minnesota railroads had been from $1.00 to $2.24. He has also contributed a letter on the railroad land grants which clears away some of the fog which has enveloped many of the newspaper and legislative discussions of the subject.

A short time ago Mr. Harris, of the Chicago, Burlington & Quincy road, wrote a letter in answer to a request for better accommodations for passenger travel on the Galva & New Boston Branch, pointing out the fact that by the present law of Illinois the company is required to charge equal rates for equal distances on all parts of its lines. Some of these, the Galva & New Boston Branch among them, do not have a tenth of the traffic of other parts, and with the same rates which give a fair return for the whole property will not earn their working expenses scarcely. If the accommodations requested were given, the other parts of the road would have to pay for them, and it is not good policy for the company nor just to its patrons to make Aurora and Galesburg pay for the hauling of passengers and freight from Keithsburg and New Boston, which is just what they would be doing if those towns had accommodations which cost more than they paid for them.

These are but examples of a good work which railroad men may do and which hardly any one else can do. We shall have unreasonable prejudice and oppressive legislation just so long as ignorance prevails, and the ignorance can be dispelled only by the efforts of those who are themselves well informed. These will, at best, make slow headway; but it is not necessary to convince everybody to prevent much unwise action. Meanwhile the railroad men would learn something of their duties to the community, doubtless, while the community was learning from them some of the rights of the railroads and the fallaciousness of many of the arguments against their practices.

American and English Bridges.

A distinguished English civil engineer and builder of iron bridges, Mr. Ewing Matheson, has taken exception to a paragraph in our notice of the International Bridge at Buffalo, in which we said, "It may be interesting to examine why it is the Canadians prefer the American system of iron bridge building to that employed in England and her Asiatic colonies."

We publish his letter in reply, which is certainly an able statement of that side of the question, and worthy of the attention of our readers. Next week we shall give a letter written by an eminent American civil engineer on the other side of the question. The following week we shall try to sum up in a judicial manner the various points in the controversy.

We expect soon to publish also a translation of an elaborate paper contributed by Mr. Charles Bender, of New York, to the Society of German Engineers on American Truss Bridges, which, as the work of a European engineer familiar with European bridge structures as well as with American structures and practice, has a special interest to bridge engineers here and abroad.

Record of New Railroad Constructions.

This number of the RAILROAD GAZETTE has information of the laying of track on new railroads as follows:

Mississippi Valley & Ship Island.—Completed from Vicksburg southward 10 miles to Goodrum's Miss. *Washington & Ohio.*—Extended from Hamilton, Va., westward 4 miles to Purcellville. *Lewisburg Centre & Spruce Creek.*—Extended from Mifflinburg westward 8 miles to Laurelton, Pa. *Parker & Karns City.*—Extended from Petrolia to Karns City, Pa., 4 miles. *Mississippi Valley & Western.*—Extended from West Quincy southward 12 miles to Hannibal, Mo. *Des Moines & Minnesota.*—Track is laid on this 3-feet road from Des Moines, Iowa, northward 10 miles.

This is a total of 48 miles of new railroad, making 246 miles completed in the United States in 1874.

Annual Meetings.

The Seventh Annual Convention of the **Master Mechanics' Association** will meet in Chicago, Tuesday, **May 12.**

The Sixth Annual Convention of the **American Society of Civil Engineers** will meet in New York, Wednesday, June 10.

The Eighth Annual Convention of the **Master Car-Builders' Association** will be held in Cincinnati, Wednesday, June 10.

A **Purchasing Agents' Association** has been formed, and a convention to which the purchasing agents of all railroads in the United States are invited, is to be held at the Grand Pacific Hotel, Chicago, on Wednesday, June 17 next. Mr. G. C. Breed, of the Louisville & Nashville, acts as Secretary.

The **Illinois Commissioners' Schedules** were enacted into a law by a vote of the Senate (having previously passed the House) March 24.

Contributions.

Commentary on the Catechism.

To the Editor of the Railroad Gazette:

In a recent issue of your valuable paper you announced your readiness to answer questions that may occur to your readers; therefore I send you the following, trusting to see answers in due time.

(1). Are you absolutely correct, or only approximately so, when you state upon page 33 of the current volume, in reply to question 42, "In fig. 14 the piston has moved 12 in., or is at half stroke, and the valve has moved as far as it will in that direction?" I think in this case the valve will continue to move in that direction until the crank is *directly* down, as the eccentric is at a right angle to the crank; and when the valve has travelled as far as it will in this direction, the piston will have travelled .864 inches past half stroke, or 12.864 in.

(2). Which is the most common definition of the throw of an eccentric in this country and England—that given (substantially) in the reply to the 42d question: "The diameter of the circle which the centre of the eccentric describes around the centre of the crank-shaft," or the radius of that circle?

The latter definition is given upon page 83, Railroad Gazette for 1871, and apparently good reasons therefor, viz., "the movement produced by an eccentric is exactly the same as that of a crank, the throw of which is equal to the throw of the eccentric. * * * * * Some writers on the steam engine define the throw as the diameter of the circle described by the centre of the eccentric. It is, however, a matter of very little consequence whether the diameter or the radius be called the throw, provided that one definition be adhered to. The one above adopted (the radius), however, seems preferable, as it is analagous to that given for the throw of the crank, which is almost invariably taken as the radius of the circle described by the crank pin."

(3). In the diagram representing motion curves, also upon page 33, it seems that the position of the valve has been found for five different positions of the crank or piston. Now I wish to know how many positions of the valve it is *necessary* to find, in constructing a motion curve diagram, and how are we to know what curve to draw the line upon between the different positions of the valve? In fig. 24 the line curves out very rapidly from *h* to *i*, and then more gradually.

The question is, How are we to determine the curve of the line between *h* and *i*, so that we can tell the position of the valve when the piston has moved one inch, two inches, &c.?

Locomotive Engineer.

[In reply to our correspondent's first enquiry, we will say that it is only approximately correct to say that the valve in fig. 14 has moved as far as it will go when the piston is at half-stroke. Owing to the angularity of the connecting-rod, as has been explained, the crank is not at half-stroke when the piston is, but is somewhat behind the latter, so that the eccentric has not quite reached the limit of its throw. It is then, however, just about to pass the centre, and in that position imparts so little movement to the valve that it was disregarded, as a full explanation would have unnecessarily complicated what was intended only for an elementary explanation of the action of the valve.

2. In speaking of the "*throw* of the eccentric," we use the term to indicate the diameter of the circle described by the centre of the eccentric, and think it is the most accurate definition, as it is the distance which it moves or *throws* the valve. The term is, we think, most commonly used in that sense in this country, and is seldom applied to the crank, but the work *stroke* is used to designate the *throw* of the crank.

3. The method of drawing the motive curves will be more fully described in a future chapter on valve-gear. We will say here that in drawing a motion curve, the more points are laid down in constructing it the more accurate will it be. In drawing those which were illustrated in figs. 25, 26 and 28, the position of the valve for each inch of the stroke was laid down, but in describing the process, in order to make the description as simple as possible, only the seven positions shown in figs. 11 to 17 were referred to Editor Railroad Gazette.]

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[If it would not be too much trouble to you, we would like to have you explain a little more fully the answer to Question 75, in your Catechism of the Locomotive. We do not understand why you take less than one-third of the square inches contained inside of this boiler to get the strain, as a boiler of this size would contain 18,095 square inches, while your answer shows only 5,760 square inches.

For instance, if a boiler has 100 pounds pressure to every square inch, why do you multiply by the diameter and not by the circumference of the boiler inside to get the number of square inches? G. W. Noyes.

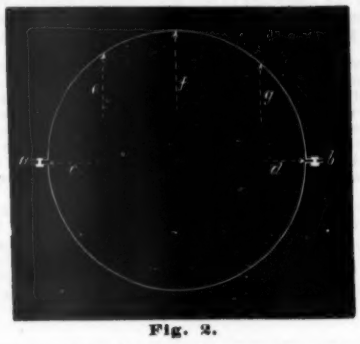
[The reason for multiplying by the diameter instead of by the circumference is because only a portion of the pressure on the inside surface of the boiler exerts a force to burst the shell at any one point. Thus, supposing the following diagram, fig. 1, to represent a section of a boiler, if

Fig. 1.

we have a force acting on the shell in the direction of the line *a b*, at the point *b*, where it is exerted against the shell of the boiler, it would be composed of two forces, one acting in the direction *b*, *c*, and tending to tear the boiler apart on the line *c*, *d*, and the other acting in the direction *f*, *b*, to tear it apart on the line *f*, *g*. It is so with all pressure inside the boiler, excepting that, say *a*, *f*, which acts exactly at right angles to the line of rupture *c*, *d*; it is all composed of two forces, only one of which tends to tear the boiler apart at one point. It is therefore only a part of the pressure on the circumference which tends to burst the boiler at a given place, and that part is equivalent to the pressure on a surface whose width is equivalent to the diameter and not the circumference.

This we know is a little difficult for those to understand who are not familiar with the principles of what is called the "resolution of forces," and we will therefore try to make it clear in another way.

To do this we will suppose that we have a boiler, *a*, *b*, fig. 2, made in two halves and bolted together at *a* and *b*



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by flanges. It is evident that if we brought a pressure against the inside of the flanges in the direction of the darts, *c* and *d*, such a pressure would not have a tendency to tear apart the bolts, *a* and *b*. Some distortion of the boiler might in fact take place, if, for example, we put a jack-screw inside and forced out the flanges as indicated, without subjecting the bolts to a tensile strain. We see therefore that the forces acting in the direction *c* and *d* have no tendency to tear apart the bolts at *a* and *b*, but it is only the forces such as *e*, *f* and *g*, which act at right angles to *a* and *b*, which exert a strain on the flanges.

That this force is equivalent to a pressure on a surface with a width equal to the diameter of the boiler is apparent if we suppose that we have a boiler, *a*, *b*, fig. 3, and that

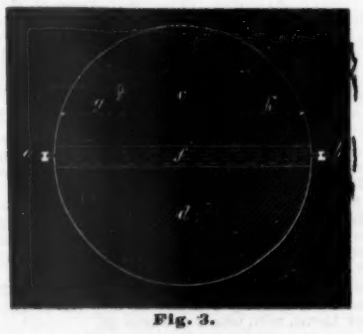

Fig. 3.

each half, *c* and *d*, is nearly filled with some substance, say wood or cement, which is fitted so tight that no steam can get between it and the shell of the boiler. It is apparent now that if we admit steam into the space *f*, the force exerted on the bolts *a* and *b* is that due to the pressure on the surface of the wood or cement exposed to the steam whose width is equal to the diameter of the boiler. It might be said though that if this substance were elastic, like india-rubber or steam, the effect of the steam would be different. If it were elastic, and a pressure on the surfaces *f* caused it to spread in the direction *g* and *h* so as to produce a pressure in that direction, it would, as has already been shown, not exert a force on the bolts *a* and *b* to tear them apart, but have a tendency to rupture the boiler at right angles to *a b*.—Editor Railroad Gazette.]

Comparative Receipts and Expenses of Three Trunk Railroads.

Philadelphia, March 25, 1874.

To the Editor of the Railroad Gazette:

In your editorial of March 21, comparing the receipts and expenses of the Pennsylvania, Erie and New York Central railroads, you have, unintentionally no doubt, done injustice in the comparison, to the Pennsylvania road, through an error in the calculation of the expenses of the passenger business of the Erie and New York Central roads, its great rivals.

The annual reports of these two last named lines do not subdivide the expenses between the freight and passenger business, but as the *percentage* of expenses to receipts varies comparatively little from year to year, we can apply the percentage of 1872 (it varies but a trifle from that for 1871) to the receipts for 1873. In 1872 the Erie passenger receipts were $3,329,346 and the expenses were $3,288,327, or *ninety-nine* per cent. If the receipts from mails, &c., are included it will reduce the proportion to 94 per cent. For 1872 the New York Central passenger receipts were $6,662,006 and the expenses were $4,915,419, or 74 per cent. If the receipts from mails are included the percentage will be reduced to 71 per cent. We will take the most favorable figures for the New York roads, viz., those which make the passenger expenses of the Erie 94 per cent. of the receipts, and of the Central 71 per cent., and apply them to the business of 1873, and the corrected table will stand as follows:

Receipts, Expenses and Profits per passenger per mile on the Pennsylvania, Erie and New York Central Railroads.

	Penn.	Erie.	N. Y. C.
Receipts per passenger per mile.....	2.48c.	2.22c.	2.06c.
Expenses per passenger per mile.....	2.01c.	2.08c.	1.46c.
Profits per passenger per mile.....	0.47c.	0.16c.	0.60c.

The other figures and percentages given in your well considered editorial are so almost perfectly correct that I am tempted to trust that you will print this slight correction.

A Pennsylvanian.

[Our correspondent's corrections are good so far as the Erie is concerned, but we believe not for the New York Central & Hudson River, which, we continue to believe, has not divided the expenses from passenger and freight business, except arbitrarily, in its reports. It is true that the one for the year ending with September gives expenses as "allotted to passenger transportation" a sum which is nearly 74 per cent. of the passenger receipts; but it divides all the expenses between passenger and freight business, and allots none to six other items, aggregating more than 10 per cent. of the total receipts, one of which is mails, the addition of which to passenger receipts would bring down the percentage of expenses to 71.7 per cent., while express receipts are doubtless included in the $1,300,000 called "miscellaneous." By the report, the passenger traffic was done at a cost of 74 per cent. of the receipts; the freight traffic at 70.92 per cent., and $2,659,000 of other receipts cost nothing.

As to the Erie, while the report from which we made our deductions did not separate the expenses for passenger and freight, a report to the stockholders for the first three quarters of the same year did, and we certainly would have done better to use that report, and by doing so we will, we think, improve on "A Pennsylvanian's" results.

By this report, the passenger expenses of the Erie Railway for the nine months ending with June, 1873, were 111 per cent. of its passenger receipts, and while it received an average of 2.23 cents for carrying a passenger one mile, that service cost it 2.475 cents, and the loss to the company was 0.245 cent per passenger per mile.

But there is another result from this division of expenses which our correspondent has failed to take into account. By as much as the passenger expenses were greater than those we assumed, by so much were the freight expenses less; and while the Erie, its total working expenses being 67 per cent., paid 111 per cent. of its passenger receipts for passenger expenses, its freight expenses were only 60 per cent. of its freight receipts, and with an average receipt of 1.56 cents per ton per mile the average expense was 0.936 cent, and the average profit 0.624 cent. This makes its freight expenses nearly as low as the Pennsylvania's and its profit per ton per mile greater. It is noticeable that the Erie's average receipt per ton per mile, which was 1.56 cents for the first three-quarters of the year, was only 1.454 for the whole year.—Editor Railroad Gazette.]

Spliced Cars.

New York, March 29, 1874.

To the Editor of the Railroad Gazette:

I inclose a very interesting letter from Benj. H. Latrobe, one of the oldest and most honored railway engineers of this country, in reference to "spliced cars," showing the origin of the long cars on two four-wheeled bogies, a system now, and for a long time, universally adopted throughout this country, and to which the railway interests, no doubt, owe much in the matter of economy in working their lines. Mr. Boyd Thompson, of the Northern Railway of Buenos Ayres, in reporting to his directors in London, says in reference to the American 8-wheeled double bogie cars on that line that, "The American

RAILROAD GAZETTE

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CONTENTS.

Editorial Announcements.

Addresses.—*Business letters should be addressed and drafts made payable to* THE RAILROAD GAZETTE. *Communications for the attention of the Editors should be addressed* EDITOR RAILROAD GAZETTE.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies, the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and in their management, particulars as to the business of railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

RAILROADS SEIZED BY STRIKERS.

During the past few months there have been several demonstrations by railroad employes, which are in reality acts of war, usually not for an advance of wages or a change in the conditions of their service, but to collect their dues. The first of these was on the New Jersey Southern, where the men, despairing of ever getting their pay, ran the engines to the round-houses, blocked the road, and declared that the road should not be worked until they got their pay. Probably almost every honest man sympathized with these men in their indignation. Not only were their wages in arrears for a long period, but it is quite probable that the managers of the property had made no provision for their payment and kept them in their service with scarcely any expectation of paying them.

The next case that we call to mind is that of the New York & Oswego Midland, which had likewise incurred obligations with a recklessness, to say the least, which was almost criminal; but had already gone into the hands of its creditors, and was being worked by a receiver for their sole benefit, the first lien of all being that of the men.

Last we have the great strike on the Erie at Susquehanna depot, where the men, as a means of enforcing claims which, so far as reported to us, seem to be reasonable, deliberately took possession of the company's shops and trains and put an end to its most important business as deliberately and decidedly as the Confederates did on the Baltimore & Ohio during the war, when in open hostility.

Now it makes no difference what or how well grounded the wrongs were of which the men complained in any of these cases. Their acts were flat rebellion, not simply against the companies in whose service they were, but against the law of the land. It was a defiance to every law-abiding citizen, and the assertion of a right of self-enforcement of personal rights such as would be fatal to all order, the general or even common practice of which would of necessity bring us back to the dark ages, with a fortification on every hill, a large part of the community constantly engaged in actual warfare, and the prevalence of robbery and all crimes under the pretence of and even in the honest effort to secure the observation of personal rights.

In a barbarous society, men have to depend pretty much on the strength of their several arms and the sharpness of their several wits for the enforcement of their rights, whether these be the collection of a debt, or the punishment of inquiries. When Speaking Bear agrees to pay Buffalo Eye two dressed robes and a deer skin for a scalping knife and a pint of whisky which the latter brave has acquired from the trader, Buffalo Eye knows that if his red brother, Speaking Bear, should become angry, or conclude that the bargain was too hard a one, or for any other reason conclude not to keep his bargain, he the creditor will not be likely to get the skins promised unless he can with his own force overcome that dishonest Bear, and cause him to fear something worse than the loss of the peltry in question. There will be no constable, no replevin, no display of the united forces of the tribe to compel Speaking Bear to keep his contract.

One of the first and most essential of the steps from savagery towards civilization is that which takes away from the individual the right to enforce his own rights and which substitutes therefore the united force and authority of the community, which, on proof of a wrong, sets about righting it with the strength and the wealth of the whole nation behind it.

Now while the advantages of the civilized procedure are so great that it would be superfluous to enumerate them, still it must be confessed that there is a promptness about the barbarous system which not unfrequently the most civilized admire and covet. It is vastly more satisfactory, for instance, when your neighbor is caught riding off to market the fine horse which he had just sold to you to be able to arrest him in his course by "drawing a bead on him," and to enforce the fulfilment of the contract then and there with cold lead; or, by seizing his lodge, ponies, squaw, papooses, and other property, induce him to fulfill the promises he has neglected to keep. But in view of the fact that in such a society it is the man with muscle or wit, and not the one with the just claim, who succeeds, civilized communities have united in agreeing that this admirable promptness is too dearly purchased.

The one mistake made by the Erie Company, *after its trains had been seized*, was in treating at all with men who were making actual war upon it. The soldiers cannot be sent for too early when actual hostilities have begun. Probably enough, the company's managers felt that there was so good ground for the complaints, or some of the complaints, of the men, that they would have preferred to excuse their crime even, if it had not become so serious.

The circumstances can hardly be imagined in which men, without the authority of the law, would be justified in seizing their employer's property and stopping his business by violence. It is never necessary for the purpose of securing their claims, for it really adds nothing to their security and does much to lessen the employer's ability to pay. Wisely, the law provides that the workmen have the first lien on railroad property. No mortgage can deprive them of their priority, and so long as the dues to workmen do not exceed the price which the whole railroad property will bring at mortgage sale, their claims are fully secured.

Strikes—the refusal to work unless fair wages and fair treatment are given—may be entirely justifiable; but such acts as these will bring discredit on all engaged in them, and more and more prejudice employers, already too much prejudiced, against the claims of workmen. Imagine a servant girl disconnecting the water and gas, putting the range out of order, and locking up the kitchen, and coolly declaring that there shall be no cooking in that kitchen till she gets her pay, and the right to two "afternoons out" weekly. Even she knows better than that, and if she did not a policeman would soon convince her. So when other employes are similarly ignorant and similarly violent, they must be taught by officers of the law: by those with writs, if the men will obey them, if not, by those with bayonets.

Railroad Men in the Newspapers.

Railroad discussions in the newspapers are usually very one-sided affairs, in which the recklessness with which charges are made is only equaled by the ignorance of railroad business displayed. This ignorance, however, is not always the fault of the writer; for the men who are familiar with railroad business, the railroad men themselves, show a reprehensible tendency to put their lights under bushels, and the conscientious journalist or legislator finds great difficulty in obtaining information on the subject which he is in a manner forced to discuss, or of the opinions which railroad men hold on matters which they are compelled to study. This is all wrong. When an influential newspaper, or a prominent public speaker, gives utterance to an impeachment of railroad management, intended for the public information, in which most of the statements are positively false, and most of the arguments fallacious, as is the case almost daily, railroad men should not let it pass unchallenged. It is true that the public may be disinclined to trust their contradictions; but the writers and speakers at least are likely to learn something and cease in some degree (when they are not utter demagogues) to repeat the statements proved false and the arguments clearly demonstrated to be fallacious. But these wild screeds are scarcely ever contradicted, and the great public, which has no other sources of information, not unnaturally suppose these uncontradicted statements to be unanswered because they are unanswerable.

Recently there have been instances of railroad managers taking part in discussions; and these, it seem to us, deserve to be encouraged and imitated. Indeed, in these days a popular defence of a railroad's policy may often be a duty of its managers, as it may be essential to the preservation of the property to its proprietors, or at least some of their rights in their property. We have heretofore noted Mr. James F. Joy's series of letters to the Detroit papers on the bridge question, and have copied other utterances of his, directed to sundry parties on sundry subjects pertaining to railroads, which will doubtless have much weight. Mr. J. W. Bishop, General Manager of the St. Paul & Sioux City and Sioux City & St. Paul roads, has contributed several letters which give facts and logic which should forever put an end to much of the loose talk in that State. For instance, in a circular addressed to the Minnesota Legislature, he showed from the official reports of the State that the average net earnings per mile of the mileage worked in the State for three years had been $697.93 in 1870–71, $366.87 in 1871–72, and $661.97 in 1872–73, the average having been but $566.12, which is at about 2 per cent. on the average cash cost of the roads as the Railroad Commissioner estimated it, which is not half of the average capital account. He gives the figures for his own roads and makes it plain to the humblest capacity that they are making far too little money, instead of too much. Another letter of Mr. Bishop's was in correction of a statement of the cost of running freight trains made in a debate of the Legislature. This statement made it out to be 24 cents per train mile, while Mr. Bishop showed by the Railroad Commissioners' Report that the actual cost on Minnesota railroads had been from $1.00 to $2.24. He has also contributed a letter on the railroad land grants which clears away some of the fog which has enveloped many of the newspaper and legislative discussions of the subject.

A short time ago Mr. Harris, of the Chicago, Burlington & Quincy road, wrote a letter in answer to a request for better accommodations for passenger travel on the Galva & New Boston Branch, pointing out the fact that by the present law of Illinois the company is required to charge equal rates for equal distances on all parts of its lines. Some of these, the Galva & New Boston Branch among them, do not have a tenth of the traffic of other parts, and with the same rates which give a fair return for the whole property will not earn their working expenses scarcely. If the accommodations requested were given, the other parts of the road would have to pay for them, and it is not good policy for the company nor just to its patrons to make Aurora and Galesburg pay for the hauling of passengers and freight from Keithsburg and New Boston, which is just what they would be doing if those towns had accommodations which cost more than they paid for them.

These are but examples of a good work which railroad men may do and which hardly any one else can do. We shall have unreasonable prejudice and oppressive legislation just so long as ignorance prevails, and the ignorance can be dispelled only by the efforts of those who are themselves well informed. These will, at best, make slow headway; but it is not necessary to convince everybody to prevent much unwise action. Meanwhile the railroad men would learn something of their duties to the community, doubtless, while the community was learning from them some of the rights of the railroads and the fallaciousness of many of the arguments against their practices.

American and English Bridges.

A distinguished English civil engineer and builder of iron bridges, Mr. Ewing Matheson, has taken exception to a paragraph in our notice of the International Bridge at Buffalo, in which we said, "It may be interesting to examine why it is the Canadians prefer the American system of iron bridge building to that employed in England and her Asiatic colonies."

We publish his letter in reply, which is certainly an able statement of that side of the question, and worthy of the attention of our readers. Next week we shall give a letter written by an eminent American civil engineer on the other side of the question. The following week we shall try to sum up in a judicial manner the various points in the controversy.

We expect soon to publish also a translation of an elaborate paper contributed by Mr. Charles Bender, of New York, to the Society of German Engineers on American Truss Bridges, which, as the work of a European engineer familiar with European bridge structures as well as with American structures and practice, has a special interest to bridge engineers here and abroad.

Record of New Railroad Constructions.

This number of the RAILROAD GAZETTE has information of the laying of track on new railroads as follows:

Mississippi Valley & Ship Island.—Completed from Vicksburg southward 10 miles to Goodrum's Miss. *Washington & Ohio.*—Extended from Hamilton, Va., westward 4 miles to Purcellville. *Lewisburg Centre & Spruce Creek.*—Extended from Mifflinburg westward 8 miles to Laurelton, Pa. *Parker & Karns City.*—Extended from Petrolia to Karns City, Pa., 4 miles. *Mississippi Valley & Western.*—Extended from West Quincy southward 12 miles to Hannibal, Mo. *Des Moines & Minnesota.*—Track is laid on this 3-feet road from Des Moines, Iowa, northward 10 miles.

This is a total of 48 miles of new railroad, making 246 miles completed in the United States in 1874.

Annual Meetings.

The Seventh Annual Convention of the Master Mechanics' Association will meet in Chicago, Tuesday, May 12.

The Sixth Annual Convention of the American Society of Civil Engineers will meet in New York, Wednesday, June 10.

The Eighth Annual Convention of the Master Car-Builders' Association will be held in Cincinnati, Wednesday, June 10.

A Purchasing Agents' Association has been formed, and a convention to which the purchasing agents of all railroads in the United States are invited, is to be held at the Grand Pacific Hotel, Chicago, on Wednesday, June 17 next. Mr. G. C. Breed, of the Louisville & Nashville, acts as Secretary.

The Illinois Commissioners' Schedules were enacted into a law by a vote of the Senate (having previously passed the House) March 24.

Contributions.

Commentary on the Catechism.

To the Editor of the Railroad Gazette:

In a recent issue of your valuable paper you announced your readiness to answer questions that may occur to your readers; therefore I send you the following, trusting to see answers in due time.

(1). Are you absolutely correct, or only approximately so, when you state upon page 33 of the current volume, in reply to question 42, "In fig. 14 the piston has moved 12 in., or is at half stroke, and the valve has moved as far as it will in that direction?" I think in this case the valve will continue to move in that direction until the crank is *directly* down, as the eccentric is at a right angle to the crank; and when the valve has travelled as far as it will in this direction, the piston will have travelled .864 inches past half stroke, or 12.864 in.

(2). Which is the most common definition of the throw of an eccentric in this country and England—that given (substantially) in the reply to the 42d question: "The diameter of the circle which the centre of the eccentric describes around the centre of the crank-shaft," or the radius of that circle?

The latter definition is given upon page 83, Railroad Gazette for 1871, and apparently good reasons therefor, viz., "the movement produced by an eccentric is exactly the same as that of a crank, the throw of which is equal to the throw of the eccentric. * * * * * Some writers on the steam engine define the throw as the diameter of the circle described by the centre of the eccentric. It is, however, a matter of very little consequence whether the diameter or the radius be called the throw, provided that one definition be adhered to. The one above adopted (the radius), however, seems preferable, as it is analagous to that given for the throw of the crank, which is almost invariably taken as the radius of the circle described by the crank pin."

(3). In the diagram representing motion curves, also upon page 33, it seems that the position of the valve has been found for five different positions of the crank or piston. Now I wish to know how many positions of the valve it is *necessary* to find, in constructing a motion curve diagram, and how are we to know what curve to draw the line upon between the different positions of the valve? In fig. 24 the line curves out very rapidly from *h* to *i*, and then more gradually.

The question is, How are we to determine the curve of the line between *h* and *i*, so that we can tell the position of the valve when the piston has moved one inch, two inches, &c.?

Locomotive Engineer.

[In reply to our correspondent's first enquiry, we will say that it is only approximately correct to say that the valve in fig. 14 has moved as far as it will go when the piston is at half-stroke. Owing to the angularity of the connecting-rod, as has been explained, the crank is not at half-stroke when the piston is, but is somewhat behind the latter, so that the eccentric has not quite reached the limit of its throw. It is then, however, just about to pass the centre, and in that position imparts so little movement to the valve that it was disregarded, as a full explanation would have unnecessarily complicated what was intended only for an elementary explanation of the action of the valve.

2. In speaking of the "*throw* of the eccentric," we use the term to indicate the diameter of the circle described by the centre of the eccentric, and think it is the most accurate definition, as it is the distance which it moves or *throws* the valve. The term is, we think, most commonly used in that sense in this country, and is seldom applied to the crank, but the work *stroke* is used to designate the *throw* of the crank.

3. The method of drawing the motive curves will be more fully described in a future chapter on valve-gear. We will say here that in drawing a motion curve, the more points are laid down in constructing it the more accurate will it be. In drawing those which were illustrated in figs. 25, 26 and 28, the position of the valve for each inch of the stroke was laid down, but in describing the process, in order to make the description as simple as possible, only the seven positions shown in figs. 11 to 17 were referred to Editor Railroad Gazette.]

To the Editor of the Railroad Gazette:

[If it would not be too much trouble to you, we would like to have you explain a little more fully the answer to Question 75, in your Catechism of the Locomotive. We do not understand why you take less than one-third of the square inches contained inside of this boiler to get the strain, as a boiler of this size would contain 18,095 square inches, while your answer shows only 5,760 square inches.

For instance, if a boiler has 100 pounds pressure to every square inch, why do you multiply by the diameter and not by the circumference of the boiler inside to get the number of square inches? G. W. Noyes.

[The reason for multiplying by the diameter instead of by the circumference is because only a portion of the pressure on the inside surface of the boiler exerts a force to burst the shell at any one point. Thus, supposing the following diagram, fig. 1, to represent a section of a boiler, if

Fig. 1.

we have a force acting on the shell in the direction of the line *a b*, at the point *b*, where it is exerted against the shell of the boiler, it would be composed of two forces, one acting in the direction *b*, *c*, and tending to tear the boiler apart on the line *c*, *d*, and the other acting in the direction *f*, *b*, to tear it apart on the line *f*, *g*. It is so with all pressure inside the boiler, excepting that, say *a*, *f*, which acts exactly at right angles to the line of rupture *c*, *d*; it is all composed of two forces, only one of which tends to tear the boiler apart at one point. It is therefore only a part of the pressure on the circumference which tends to burst the boiler at a given place, and that part is equivalent to the pressure on a surface whose width is equivalent to the diameter and not the circumference.

This we know is a little difficult for those to understand who are not familiar with the principles of what is called the "resolution of forces," and we will therefore try to make it clear in another way.

To do this we will suppose that we have a boiler, *a*, *b*, fig. 2, made in two halves and bolted together at *a* and *b*

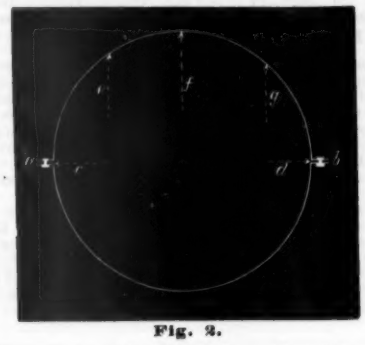


Fig. 2.

by flanges. It is evident that if we brought a pressure against the inside of the flanges in the direction of the darts, *c* and *d*, such a pressure would not have a tendency to tear apart the bolts, *a* and *b*. Some distortion of the boiler might in fact take place, if, for example, we put a jack-screw inside and forced out the flanges as indicated, without subjecting the bolts to a tensile strain. We see therefore that the forces acting in the direction *c* and *d* have no tendency to tear apart the bolts at *a* and *b*, but it is only the forces such as *e*, *f* and *g*, which act at right angles to *a* and *b*, which exert a strain on the flanges.

That this force is equivalent to a pressure on a surface with a width equal to the diameter of the boiler is apparent if we suppose that we have a boiler, *a*, *b*, fig. 3, and that

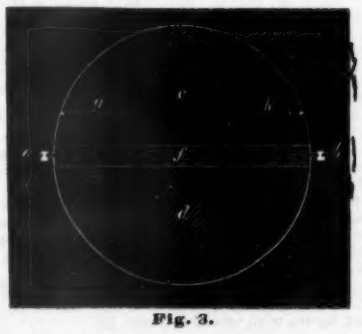


Fig. 3.

each half, *c* and *d*, is nearly filled with some substance, say wood or cement, which is fitted so tight that no steam can get between it and the shell of the boiler. It is apparent now that if we admit steam into the space *f*, the force exerted on the bolts *a* and *b* is that due to the pressure on the surface of the wood or cement exposed to the steam whose width is equal to the diameter of the boiler. It might be said though that if this substance were elastic, like india-rubber or steam, the effect of the steam would be different. If it were elastic, and a pressure on the surfaces *f* caused it to spread in the direction *g* and *h* so as to produce a pressure in that direction, it would, as has already been shown, not exert a force on the bolts *a* and *b* to tear them apart, but have a tendency to rupture the boiler at right angles to *a b*.—Editor Railroad Gazette.]

Comparative Receipts and Expenses of Three Trunk Railroads.

Philadelphia, March 25, 1874.

To the Editor of the Railroad Gazette:

In your editorial of March 21, comparing the receipts and expenses of the Pennsylvania, Erie and New York Central railroads, you have, unintentionally no doubt, done injustice in the comparison, to the Pennsylvania road, through an error in the calculation of the expenses of the passenger business of the Erie and New York Central roads, its great rivals.

The annual reports of these two last named lines do not subdivide the expenses between the freight and passenger business, but as the *percentage* of expenses to receipts varies comparatively little from year to year, we can apply the percentage of 1872 (it varies but a trifle from that for 1871) to the receipts for 1873. In 1872 the Erie passenger receipts were $3,329,346 and the expenses were $3,288,327, or *ninety-nine* per cent. If the receipts from mails, &c., are included it will reduce the proportion to 94 per cent. For 1872 the New York Central passenger receipts were $6,662,006 and the expenses were $4,915,419, or 74 per cent. If the receipts from mails are included the percentage will be reduced to 71 per cent. We will take the most favorable figures for the New York roads, viz., those which make the passenger expenses of the Erie 94 per cent. of the receipts, and of the Central 71 per cent., and apply them to the business of 1873, and the corrected table will stand as follows:

Receipts, Expenses and Profits per passenger per mile on the Pennsylvania, Erie and New York Central Railroads.

	Penn.	Erie.	N. Y. C.
Receipts per passenger per mile.....	2.48c.	2.92c.	2.06c.
Expenses per passenger per mile.....	2.01c.	2.08c.	1.46c.
Profits per passenger per mile.....	0.47c.	0.10c.	0.60c.

The other figures and percentages given in your well considered editorial are so almost perfectly correct that I am tempted to trust that you will print this slight correction.

A Pennsylvanian.

[Our correspondent's corrections are good so far as the Erie is concerned, but we believe not for the New York Central & Hudson River, which, we continue to believe, has not divided the expenses from passenger and freight business, except arbitrarily, in its reports. It is true that the one for the year ending with September gives expenses as "allotted to passenger transportation" a sum which is nearly 74 per cent. of the passenger receipts; but it divides all the expenses between passenger and freight business, and allots none to six other items, aggregating more than 10 per cent. of the total receipts, one of which is mails, the addition of which to passenger receipts would bring down the percentage of expenses to 71.7 per cent., while express receipts are doubtless included in the $1,300,000 called "miscellaneous." By the report, the passenger traffic was done at a cost of 74 per cent. of the receipts; the freight traffic at 70.92 per cent., and $2,659,000 of other receipts cost nothing.

As to the Erie, while the report from which we made our deductions did not separate the expenses for passenger and freight, a report to the stockholders for the first three quarters of the same year did, and we certainly would have done better to use that report, and by doing so we will, we think, improve on "A Pennsylvanian's" results.

By this report, the passenger expenses of the Erie Railway for the nine months ending with June, 1873, were 111 per cent. of its passenger receipts, and while it received an average of 2.23 cents for carrying a passenger one mile, that service cost it 2.475 cents, and the loss to the company was 0.245 cent per passenger per mile.

But there is another result from this division of expenses which our correspondent has failed to take into account. By as much as the passenger expenses were greater than those we assumed, by so much were the freight expenses less; and while the Erie, its total working expenses being 67 per cent., paid 111 per cent. of its passenger receipts for passenger expenses, its freight expenses were only 60 per cent. of its freight receipts, and with an average receipt of 1.56 cents per ton per mile the average expense was 0.936 cent, and the average profit 0.624 cent. This makes its freight expenses nearly as low as the Pennsylvania's and its profit per ton per mile greater. It is noticeable that the Erie's average receipt per ton per mile, which was 1.56 cents for the first three-quarters of the year, was only 1.454 for the whole year.—Editor Railroad Gazette.]

Spliced Cars.

New York, March 29, 1874.

To the Editor of the Railroad Gazette:

I inclose a very interesting letter from Benj. H. Latrobe, one of the oldest and most honored railway engineers of this country, in reference to "spliced cars," showing the origin of the long cars on two four-wheeled bogies, a system now, and for a long time, universally adopted throughout this country, and to which the railway interests, no doubt, owe much in the matter of economy in working their lines. Mr. Boyd Thompson, of the Northern Railway of Buenos Ayres, in reporting to his directors in London, says in reference to the American 8-wheeled double bogie cars on that line that, "The American

cars are in every respect better and more comfortable, requiring less than one-half the power to propel them, than is necessary for the English. The English carriages are much more injurious to the permanent way and works, and likewise in proportion more destructive to themselves than those of American make. I consider that cars of American make would be preferable to any other class. They cost less, are not so expensive to keep in repair, run easier, and cause less wear and tear on the permanent way." This testimony comes from a Scotchman who had never been in the United States. A Yankee full of conceit in advocating a hobby could not come out stronger.

The little history of the American 8-wheeled car, as written by Mr. Latrobe, will, I think, be interesting to many of your readers. W. W. EVANS.

MR. LATROBE'S LETTER.

BALTIMORE, March 27, 1874.

W. W. Evans, Esq., Civil Engineer, New York.

DEAR SIR—In the RAILROAD GAZETTE of the 27th of last December there is an account of "Spliced Carriages on the Mexican Railway" which reminded me of an incident in the history of the railroad between Baltimore and Philadelphia, the section of which, some thirty-five miles in length from this city to Havre de Grace upon the Susquehanna, was constructed under my direction as its Engineer in the years 1835-6 & 7. The remainder of the line thence to Philadelphia, being built under a different charter and administration, although by the same general interest, there was a difference of opinion between the directories of the two divisions of the road as to the description of passenger car to be adopted for the through travel. The long eight-wheel car with a swivelling truck under each end had been introduced upon the Baltimore & Ohio Railroad in 1833, and the Washington Branch of the road was opened in 1835 with a full complement of such cars in an improved form. The Baltimore directory preferred this model, in favor of which I had submitted a report recommending its adoption. The Wilmington directory, representing two-thirds of the whole length of the line, were of a different opinion, and adhered to the short car upon four wheels, then in use upon all the railways north of Philadelphia.

In the Spring of 1835 a committee of that directory accompanied by their Engineer, Mr. Strickland, visited Lowell, Massachusetts, where that pattern of car was being built in its most improved shape; and the result was, as stated in a letter from their President, that "Our board will not accede to the large cars, and the reasons against them are strong. In the first place, they are more expensive, one of the forty-four passenger cars on the Washington road costing $1,800, while a Lowell car that takes twenty-eight passengers costs $1,000, the former weighing nearly five tons, the latter less than two tons. The large cars, from their own weight and what they carry are much more likely to get out of order. All the roads to the eastward have sent on committees to examine the Baltimore cars; not one has adopted them."

You see that a very strong case was made out against the large car, and no wonder therefore that the majority on the Philadelphia side of the Susquehanna carried the day and compelled the minority on the Baltimore side of that river to accept the small car, the only concession they could obtain as to the cars to run over both roads being that the baggage cars designed to cross the river upon the upper deck of the steam ferry boat should be of the eight-wheel pattern. These baggage-cars, however, introduced their own type of car upon the Wilmington Division, and so recommended it that a year had not elapsed before the operation of "splicing" the bodies of the short cars was begun, and only a few of them retained in their original form for occasional use "to make up a train," as their Master Machinist said to me in a conversation upon the subject. Although obliged to accept in part the four-wheel car for the section of the road with which I was connected, I stipulated that there should be no *platforms* at the ends of those built for that section, as I feared the effect of them with passengers standing upon them on the stability and safety of the car. The wheels of these cars could not be placed more than seven feet apart in order to permit them to run through the curves of sixty feet radius at the street corners, and hence they rocked a great deal in running upon the road.

To the Baltimore & Ohio Railroad Company undoubtedly belongs the introduction of the eight-wheel passenger car, although Mr. Ross Winans, then in their service, and under whose advice and direction the first were built, was not finally successful in establishing in the courts the patent rights which he claimed in connection with it. The letter of Mr. Mills, with your comments upon it, in the number of the GAZETTE above referred to, very strikingly exhibits the superiority of the long truck-supported car, especially upon a very curved road, such as that from Vera Cruz to Mexico, and as the little bit of early railroad history I have just given shows that its advantages were seen nearly forty years back among us, the tenacity with which our English cousins cling to their time-honored ideas is more conspicuously manifested.

I am, dear sir, yours truly,

BENJ. H. LATROBE.

Transportation in Congress.

In the House on the 25th:

Mr. G. F. Hoar, of Massachusetts, proceeded to address the House in favor of the Transportation bill. He described it as proposing a wise, cautious, simple, experimental remedy for a known common-law right, and enacting that an obligation which rests on public carriers everywhere else in the civilized world, and which rests upon these railroads, so long as they are within State authority, shall continue to rest upon them when they go into the domain where the national authority is paramount and exclusive. That was all there was in the bill.

At the close of the debate, after speeches by Mr. Hawley, of Illinois, and Messrs. Monroe and Smith, of Ohio, Mr. Niblack, of Indiana, moved to lay the bill on the table. The motion was negatived: Yeas, 92; Nays, 129.

In the House on the 26th:

The House proceeded to vote on the bill to regulate the commerce by railroad among the several States, and the bill was passed by Yeas, 121; Nays, 116.

The bill as passed is, with slight modifications, the same as reported by Mr. McCrary of Iowa, from the Committee on Railways and Canals, on Jan. 19. It enacts that all railroad lines carrying freight and passengers between different States, whether owned by one or by various corporations, shall be regarded as employed in commerce among the several States, and shall be liable for any violation of this act. They are forbidden to charge more than a fair and reasonable rate for the transportation of freight or passengers; such rate to be ascertained and fixed by a Board of Railroad Commissioners to be appointed by the President, with the advice and consent of the Senate, and to be residents of each of the nine judicial districts of the United States. They are to be disinterested persons and not to have any interest in the stock, bonds or property of any railroad, or any transportation company. This Board of Railroad Commissioners is to institute a thorough investigation and inquiry into the rates and toll and compensation charged for transporting freights and passengers over each of such lines of railroad, and into the reasonableness thereof; and is, as soon as practicable, after such investigation and inquiry, to prepare for the owners and operators of each of such lines, a separate schedule of reasonable maximum rates of charges for the transportation of passengers and freights and cars, on or over said lines respectively. The schedule is to be duly authenticated by the Board of Commissioners and to be printed and kept posted up in such of the offices and depots of such railroad company, corporation or person. They may from time to time and so often as circumstances may require, change and revise schedules, and shall give a notice of such changes or revisions in the same manner.

In the Senate, on the 30th, the Cheir laid before it sundry resolutions of the Wisconsin Legislature in regard to the improvement of the Mississippi River and its tributaries, and for increased mail facilities in that State, and for the improvement of the Wisconsin River. Referred to appropriate committees. Also, a letter from the Secretary of War, transmitting a report of the Board of Engineers who made an examination of the bridge over the Mississippi River at St. Louis. Referred to the Committee on Commerce.

In the House on the 30th:

Mr. Hurlbut, of Illinois, introduced a bill for the construction of the Portland, Dalles & Salt Lake Railroad, and the performance of all Government service by it free of charge.

Mr. Wheeler, of New York, from the Committee on Commerce, reported back with amendments the Senate bill providing for the payment of the bonds of the Louisville & Portland Canal Company. The bill continues in force the appropriation made in the River and Harbor bill of March 3, 1873, for the payment of the debts of the Louisville & Portland Canal Company, and makes it permanently applicable for the same. So much of it as is necessary shall be applied to the payment of the interest as it accrues and the principal of the bonds as they mature; but the Secretary of the Treasury may buy any of such bonds at their market price, not above par. The second section authorizes the Secretary of the Treasury to take possession of the canal and all its property subject to the mortgage securing the bonds, and the Secretary is to pay for the stock held by the directors, being $100 to each director, with six per cent. interest since the 9th of February, 1864, and is to collect any money due to or held for the company by its directors or the trustees, or by any person whatever. The third section provides that the canal shall be held for the common use and benefit of all the people, free of tolls and charges, except such as are necessary to pay the current expenses and to keep the canal in repair. The tolls for the present year are to be 10 cents per ton on steam vessels and five cents on other vessels.

This bill was debated at length, Mr. Willard, of Vermont, making a speech against it, in which he showed that the Government had already expended $1,278,000 on the canal since 1869 without any return, and that in 1872, with tolls at 50 cents per ton on all vessels, the income was but $207,000, so that the tolls fixed by the bill would not be likely to equal the current expenses, which have averaged $72,000 a year.

The discussion on this bill was resumed in the House on the 31st, when

Mr. Wheeler, of New York, made a speech insisting on the importance of adding a provision requiring the State of Kentucky to cede exclusive jurisdiction to the United States before the payment of any money. Mr. Wheeler's amendment was agreed to, and the bill then passed. As amended it will prevent the reduction of the tolls until the Kentucky Legislature has ceded jurisdiction, and that body does not meet for two years.

General Railroad News.

ELECTIONS AND APPOINTMENTS.

—The directors of the Buffalo & Jamestown Railroad Company met in Buffalo, N. Y., March 25, and re-elected the old officers as follows: President, Jewett M. Richmond; Vice-President, James Adams; Treasurer, Abraham Altman; Secretary, Peter C. Doyle.

—Col. C. D. Chandler, formerly General Freight Agent of the Cheshire Railroad, has been appointed General Contracting Agent of the Boston, Clinton & Fitchburg Railroad, with office at Fitchburg, Mass.

—At the annual meeting of the Maine Central Railroad Company in Portland, Me., March 25, the following directors were elected: John B. Brown, Lewis Pierce, Portland, Me.; Noah Woods, Lysander Strickland, Bangor, Me.; Darius Alden, Augusta, Me.; George M. Patten, Bath, Me.; Anson P. Morrill, Readfield, Me.; Abner Coburn, Skowhegan, Me.; Frank Jones, Portsmouth, N. H.; James P. Cook, Salem, Mass.; John Wooldredge, Lynn, Mass.; Thornton K. Lothrop, George L. Ward, Boston. Messrs. Wooldredge, Lothrop, Cook and Jones are new directors, replacing, H. N. Jose and R. D. Rice, the number of directors having been increased from 11 to 13. Mr. Wooldredge is President and Messrs. Lothrop, Jones and Morrill directors of the Eastern Railroad Company.

—Judge Green, of Upton, Ind., has been elected President of the Lafayette, Muncie & Bloomington Railroad Company, in place of Mr. Pierce, resigned.

—Mr. W. H. Franklin has been appointed Assistant Superintendent of the Western Union Railroad, with office at Racine, Wis., in place of E. F. Barnes. Mr. D. Flanigan has been appointed Assistant Superintendent of the Sabula, Ackley & Dakota Division.

—Philip Campbell has been appointed Assistant Superintendent of the Paris & Decatur Railroad, and David Brown, General Ticket Agent, with offices at Paris, Ill.

—Mr. H. H. Hunnewell, of Boston, has been elected President of the Leavenworth, Lawrence and Galveston Railroad Company, in place of J. M. Walker, resigned. Major B. S. Henning, General Superintendent of the Missouri River, Fort Scott & Gulf road, has been appointed General Superintendent of the Leavenworth, Lawrence & Galveston also.

—Mr. W. F. Simons has been appointed General Freight Agent of the Northern Railroad of New Hampshire, in place of E. L. Whitford, resigned.

—Mr. George K. Barnes has been appointed Assistant General Passenger and Ticket Agent of the West Wisconsin Railway, with office at the corner of Third and Jackson streets, St. Paul, Minn.

—V. B. Horton has been chosen President of the Atlantic & Lake Erie Railway Company.

—The first board of directors of the Delaware River & Bound Brook Railroad Company is as follows: W. Merchant, Rahway, N. J.; G. Richards, Dover, N. J.; L. H. Taylor, High Bridge, N. J.; S. K. Wilson, Trenton, N. J.; C. A. Sparks, C. P. Knight, C. Sloan, Camden, N. J.; E. C. Wright, J. G. Fell, H. Lewis, J. Riegal, O. H. Wilson, F. A. Comly, Philadelphia.

—Mr. George W. Bentley, formerly Vice-President and General Manager of the New Jersey Southern, has been appointed General Superintendent of the New London Northern Railroad.

—Mr. C. G. Memminger has been chosen President of the Spartansburg & Asheville Railroad Company.

—Mr. H. W. Fairweather has been appointed General Ticket Agent of the Pacific Division of the Northern Pacific Railroad.

—Mr. F. D. McCollum has been appointed Auditor of the New Jersey Midland Railroad, in place of F. H. Carrier, resigned.

—Mr. E. Marsh has been appointed Master of Transportation of the Louisville Division of the Louisville & Nashville Railroad, in place of D. F. Whitcomb, who has gone to the Elizabethtown & Paducah road.

—Mr. William W. Coller has been appointed Master Mechanic of the Huntington & Broad Top Railroad in place of J. Salisbury, who has resigned.

—Mr. Charles Sanders has been appointed General Freight and Passenger Agent of the Detroit, Lansing & Lake Michigan Railroad, with office at Detroit, Mich.

—Mr. James J. Davies has been appointed Auditor of the Atlanta & Richmond Air Line Railroad, with office at Atlanta, Ga.

—Mr. B. N. Bullock has been appointed Cashier of the New York & New England Railroad.

—Mr. C. D. Owens had been appointed General Agent of the Central Railroad of Georgia and its Savannah and New York York steamship line, with office at No. 409 Broadway, New York.

—The officers of the Keokuk & Des Moines Railroad are as follows: President, Henry A. Barling, New York; Secretary, A. Bridgman; General Manager, John E. Henry; General Superintendent, George H. Griggs; General Freight and Ticket Agent, John Givin; Purchasing Agent, George E. Kilbourne; Master Mechanic; James Lamb; Master Car Builder, R. E. Smith. The offices are at Keokuk, Ia.

PERSONAL.

—Mr. Remington Vernam has resigned his position as Manager of the Toledo, Peoria & Warsaw Railway.

—Mr. Joseph Harrison died in Philadelphia, March 27, in the 74th year of his age. Mr. Harrison was, thirty-five years ago, a member of the firm of Eastwick & Harrison, who were among the first builders of locomotives in the United States, and subsequently went to Russia, where in connection with Mr. Thomas Winans, of Baltimore, he secured some heavy contracts for equipment for the State railroads.

—Mr. Rush R. Sloane, formerly President of the Cincinnati, Sandusky & Cleveland Railroad Company, who defrauded the company out of a considerable amount of money, has been heard from in Belgium, which country has no extradition treaty with the United States.

—Mr. James Palmer, a conductor on the Vermont Central from 1847 to 1855, and most of the time since on Michigan Southern, for several years train master in the Chicago freight yard, but most of the time a conductor, died at Elkhart, Ind., March 25. He was an extremely faithful and honorable man, who had earned the respect of all with whom he served by his character as well as his long service.

—Mr. Charles J. Brydges, for twelve years past Managing Director of the Grand Trunk Railway, has resigned his position, to take effect on the appointment of a successor.

—Mr. James M. Hall has resigned his position as General Passenger and Ticket Agent of the Canada Southern Railway Line.

—Col. George Noble, late Assistant General Superintendent of the Kansas Pacific and now General Superintendent of the Texas & Pacific, was married to Miss Nettie Douglas, at Lawrence, Kan., March 23.

—General N. B. Forrest has resigned his position as President and a director of the Selma, Marion & Memphis Railroad Company.

TRAFFIC AND EARNINGS.

—The earnings of the Indianapolis, Bloomington & Western Railway for the third week in March were: 1874, $39,762; 1873, $26,675; increase, $13,087, or 49 per cent.

—The earnings of the Erie Railway for the second week in March were: 1874, $330,828; 1873, $375,402; decrease, $44,574, or 11⅞ per cent.

—The earnings of the Maine Central Railroad for the year 1873 were:

	1873.	1872.	Increase.	Per Ct.
Earnings	$2,068,077 78	$1,936,479 29	$131,598 49	6¾
Expenses	1,330,501 44	1,328,982 48	1,518 96	0⅛
Net earnings	$737,576 34	$607,496 81	$130,079 53	21⅜

The expenses were 64.34 per cent. of earnings in 1873, and 68.63 per cent. in 1872. Gross earnings were $5,793 per mile in 1873, and $5,424 in 1872.

—During the two months ending February 28, the Pennsylvania Railroad carried 225,829 tons (2,000 lbs.) of coal, of which 35,954 tons was anthracite. The tonnage of coke for the same period was 36 487 tons. The anthracite tonnage of the Danville, Hazleton & Wilkesbarre road was 1,134 tons.

—The earnings of the Great Western Railway of Canada for the week ending March 6 were: 1874, £21,037; 1873, £21,397; decrease, £300, or 1⅜ per cent.

—The earnings of the Grand Trunk Railway for the week ending March 7 were: 1874, £38,400; 1873, £33,900; increase, £4,500, or 13¼ per cent.

—The earnings of the Los Angeles & San Pedro Railroad for the year 1873 were:

Earnings ($8,027 per mile)	$176,596 35
Expenses (78.69 per cent.)	138 960 20
Net earnings ($1,711 per mile)	$37,636 15

—Direct steamship traffic has begun between Liverpool and Galveston, the first vessel of the new Black Star Line having sailed from the latter port. This line is to consist of five first-class vessels, two of 1,200, and three of 2,200 tons each. The larger vessels are intended to carry 4,000 bales of cotton each.

—The earnings of the West Wisconsin Railway for the month of February were: 1874, $78,127; 1873, $46,503; increase, $31,624, or 68 per cent.

The earnings of the Toledo, Wabash & Western Railway for

the third week in March were: 1874, $95,417; 1873, $111,101; decrease, $15,684, or 14⅛ per cent.

THE SCRAP HEAP.

Heating Cars in Germany.

Mr. Bayard Taylor, in one of his interesting letters, thus describes a method of heating cars in Germany:

"When I left Gotha the first cold weather had just arrived; the thermometer stood about zero, there were six inches of snow on the fields, and every traveler was bundled in furs from head to foot like a Russian. The cars were heated by tin boxes under the seats, filled with steam from the engine—surpassing in discomfort any method that could be devised. Imagine a cold floor and a hot seat! Like the process adopted for enlarging the livers of the Strasburg geese, it created a fever instead of a healthy warmth, and we reached Frankfort, after a trip of five hours, in a state of complete exhaustion. I was amazed at the endurance of a German, our only fellow-traveler in the compartment. He wore an overcoat an inch thick, sat with his feet in a deep fur bag which was drawn up to his knees, covered his lap with a heavy plaid, and then buried himself in a fur robe, while the seat under him was hot enough to char the end of the *os sacrum*. From time to time he cast a melancholy, reproachful glance upon us, who, gasping for breath, persisted in having our window open, with the right and the power which three against one usually gives."

Reducing the Diameter of Tires.

M. L. Merlet proposes the following method of reducing the inner diameter of a tire which has been unduly enlarged by the hammer or the rolls, so that it cannot be put on when hot in the usual manner. The plan consists of heating it to redness, and then plunging it horizontally, but only to half its breadth, in water, and leaving it there till quite cold. The operation is then repeated in the same position, after which the tire is turned over and the heatings and plungings applied to the other half of the ring. The first cooling produces a contraction of which the half not immersed partakes, and thus undergoes a molecular retraction resulting in a reduction of diameter; of course, the same is produced in the other half during the second operation. In this way a tire has been reduced 7 in 895; four immersions instead of two will double the shrinking. In the same manner a ring of Bessemer steel which had not only enlarged under the hammer, but had also become conical in form in the interior, was brought to the exact diameter by means of heating and immersing thirteen times successively, first the side that was contracted, and afterwards that which had become enlarged. In this case the correction amounted to nearly four inches, but the diameter of the steel ring is not given.

Condensation of Steam by Cold Surfaces.

An exchange says:

"An investigation by Reynolds, Professor of Engineering in Owen's College, Manchester, on the condensation of a mixture of air and steam upon cold surfaces, has important practical bearings in the management of the steam engine. His objects were to ascertain if there is a great difference in the rates of condensation of pure steam and a mixture of steam and air; and, again, to ascertain if the effect of the mixed air on the condensation increases as the proportion of air to steam increases. The rate of condensation of pure steam is so great, when it impinges upon a cold surface, that it is practically impossible to measure it; wherefore indirect methods of investigation were necessary. The conclusions drawn from his experiments are as follows: First, that a small quantity of air in steam does very much retard its condensation upon a cold surface; that, in fact, there is no limit to the rate at which pure steam will condense, except the power of the surface to carry off the heat. Second, that the rate of condensation diminishes rapidly, and nearly uniformly, as the air that is present increases in a proportion of from 2 to 10 per cent. of the steam, and then less and less rapidly until 30 per cent. is reached, after which the rate of condensation remains nearly constant. Third, that, in consequence of this effect of air, the necessary area of surface of a condenser for a steam engine increases very rapidly with the quantity of air allowed to be present within it. Fourth, that by mixing air with the steam before it is used, the condensation at the surface of the cylinder may be greatly diminished, and consequently the efficiency of the engine increased. Fifth, that the maximum effect, or near it, will be obtained when the pressure of the air is one-tenth that of the steam."

[The economy which has been realized from forcing air into locomotive boilers is doubtless due to the reduction of condensation of steam resulting therefrom, and referred to above.]

Railroad Manufactures.

The Taunton Locomotive Works, Taunton, Mass., are building 10 ten-wheel freight engines for the Union Pacific Railroad.

The Wason Company at Springfield, Mass., has closed contracts for new cars for the Housatonic and Connecticut Western companies.

The Baltimore & Ohio Railroad Company's rolling mills at Cumberland, Md., are in full operation, turning out about 1,050 tons of manufactured iron per week. The steel-rail mill is being worked up to its full capacity.

Limited Liability.

The Illinois Senate has passed a bill which declares "that whenever any property is received by a common carrier, to be transported from one place to another, within or without this State, it shall not be lawful for such carrier to limit his common law liability safely to deliver such property at the place to which the same is to be transported, by any stipulation or limitation expressed in the receipt given for such property."

OLD AND NEW ROADS.

Union Pacific.

The company has issued a circular announcing its readiness to give $6,000 of its 8 per cent. mortgage bonds for $5,000 of the income bonds now maturing. To facilitate exchange, the company will pay on September 1 as much interest as if the 10 per cent. bond had not been exchanged. Large holders of income bonds have already exchanged their individual holdings, nearly $3,000,000 of income bonds being absorbed in this manner out of a total of $10,000,000. The official announcement of these terms advanced the income bonds to 84½, after sales at 82 and 83 against 83 and 81¼ on Tuesday.

Railroad Aid in Illinois.

A bill has passed the Legislature and become a law which provides that all aid heretofore voted to railroads shall be forfeited if the roads are not built within three years from July 1, except in a case where the express conditions of the aid voted extend the time for the construction of the road beyond that time.

Philadelphia, Wilmington & Baltimore.

The United States Supreme Court has decided in favor of the validity of the Delaware tax law of 1869 under which the railroads of that State are taxed. The company has heretofore claimed exemption and has paid its taxes under protest.

The long trestle bridges over Bush River and Gunpowder River are being widened for an additional track. The work is nearly finished.

Des Moines & Minnesota.

A locomotive and construction train have been placed on the track. The rails are down for some ten miles northward from Des Moines. Iron for 20 miles more has been contracted for, which will carry the road to Ames, on the Chicago and Northwestern.

Texas, Mississippi River & Northwestern.

The track of this company's Chicot & Pine Bluff line was badly damaged by the recent rise in the Mississippi. Twenty breaks are reported in 11 miles, some of which will take a long time to repair.

North Wisconsin.

This company has decided to accept the St. Croix land grant and to begin preparations for building the road at once. It is stated that it has secured promises of the necessary capital, and that the company's counsel are satisfied that the title to the lands is good. The company has until May 5 to file the required security of $5,000 per mile. The grant required 40 miles to be finished this year, of which 18 are already in operation.

Delaware River & Bound Brook.

A company by this name has filed its certificates of incorporation with the Secretary of State of New Jersey. The road is to run from a point on the Delaware near the mouth of Moore's Creek northeast to the Central Railroad at Bound Brook. It will be about 27 miles long. The capital stock is to be $1,000,000.

St. Louis & Iron Mountain.

The United States Supreme Court has affirmed the decision of the Circuit Court in the case of Trask *vs.* Maguire, which held that this company was not exempt from taxation under its charter, but was liable to be taxed by the local authorities.

Potosi & Webster.

Surveys are to be made for a line from Potosi, Mo., the terminus of a branch of the St. Louis & Iron Mountain, west to Webster and thence into the iron fields of Dent County.

Boston, Clinton & Fitchburg.

Arrangements have been made for the transportation of freight from this road to Philadelphia by the Clyde steamer line.

Toledo & Grand Rapids.

A company by this name has been organized to build a narrow-gauge railroad from Grand Rapids, O., to Maumee City, to connect with the road now under construction from that place to Toledo.

Chicago, Danville & Vincennes.

It is stated that a majority of the bondholders have assented to the company's proposition to fund certain coupons.

Emigrant Rates Westward.

It was recently made public that the Erie Railway Company had made contracts with several of the principal lines of steamers running to New York, by which through emigrant tickets from New York to the West by the Erie were sold in Europe at the rate of $10 from New York to Chicago. On learning this, the New York Central & Hudson River reduced its emigrant rates, in some cases nearly one-half. The rate from New York to Chicago, late $13, is now $7; to Cincinnati, late $11.50, now $7; St. Louis, late $15.55, now $9.55, and other points in proportion. The Erie and Pennsylvania also reduced their rates to the same figures.

There has been heretofore an agreement between the three companies by which the emigrant business from New York was divided between them, and any excess of profit made by one road was paid over to the others. The other roads now accuse the Erie of bad faith in making the contract with the steamship companies. The Erie desires that the Philadelphia and Boston business shall be divided the same as the New York business, which the others are not willing to concede. It seems probable that the rates will continue at a low point for some time, as the dispute will not be speedily adjusted.

Long Island.

A lively competition has been commenced between this road and the Flushing & North Side. Rates have been reduced at the points reached by both lines, and unusual facilities are to be given for summer travel during the coming season.

General Freight Agents' Convention.

A convention of the General Freight Agents of the trunk lines and the leading express freight lines was held in New York last week. The business of the convention was mainly of a private character and was confined to the auditing of the accounts of the several companies.

New York Central & Hudson River.

This company intends to build in New York a grain elevator with a capacity for storing 1,000,000 bushels of wheat. The details of the project have not been fully decided on, but it will probably be built on the North River about Sixty-fifth street, and the building will be about 500 by 200 feet in size.

Erie.

The late history of this company has been that of a succession of strikes of employees. The latest is that of the men in the Susquehanna shops, nearly 1,000 in number, who struck in order to secure payment of the back wages due them, and a regular pay day in future. The turntable was broken and a number of locomotives disabled and for several days all trains, both freight and passenger, were stopped, though the strikers finally allowed passenger trains to pass. The company's terms having been rejected by the strikers, a call was made upon the authorities, and by the aid of the State militia the road was opened to travel again. Most of the men have been paid off and discharged, and it is said that the shops will be closed and the work taken to Port Jervis, Rochester and Hornellsville shops. The strike involved no question of increase of pay, and it is charged that it would have been avoided had the company treated the men with good faith and paid them according to agreement.

The trouble with the strikers in the Jersey City freight yard may be said to be over. Some of the strikers returned to work and the places of the others were filled by new men. A correspondent of the Scranton (Penn.) *Republican* describes the origin and progress of the troubles between the employes and the company, as explained to him by the chairman of the latter: "During the past winter the mechanics were working on three-quarter time, and even at the small rate of wages they could earn, it frequently ran into the third month before they could get their pay, and then there was no fixed time for paying. On or about the 3d of February the men struck for a regular pay-day, and the matter was settled by the company stating that they would make the 15th of every month pay-day in future, and that they would give the men their February pay on the 15th of March. The men resumed work, and when the 15th of March came notice was given through the officials that, in consequence of certain embarrassments into which the company had fallen in New York, they could not pay before the 25th. The men accordingly yielded the ten days' grace, and when the 25th came a notice appeared on the bulletin board in the shops to the effect that the paymaster had commenced paying elsewhere, and that those along the line who were paid first on last month would be paid last this time, and *vice versa*. This notice was eagerly scanned, and its contents spread throughout the entire range of shops as rapidly as a wave of fire sweeps over the parching prairie, the men taking it as an insult. Accordingly, pursuant to a resolution adopted on the 16th, work was immediately suspended by the 1,100 men, bells were rung, a mammoth steam-whistle was blown, the officials forced from the shops, mill-band and lathe and wheel were thrown idle, and the entire works cleared and under complete control of the men in about twenty minutes. In addition to striking for a regular pay-day, the mechanics also demand regular apprenticeship in the shops instead of employing unskilled labor, as at present, to do the work of mechanics; they also want to be paid up to date and receive at the rate of time-and-a-half for all overtime. The regular monthly pay of the employes in and around the machine shop averages $50,000. The population of Susquehanna Depot is about 8,000, nearly all of which is dependent on the earnings of the men employed in the Erie Railroad Company's machine shops."

Boston & Maine.

The City Council of Portland, Me., has granted the company authority to lay the necessary tracks on Commercial street to make connection with the Grand Trunk track and station. It is probable that the Boston & Maine trains will run to the Grand Trunk Depot until the new depot is finished.

Portland & Ogdensburg.

The contract with the Eastern Railroad Company has been signed and delivered. It is simply a traffic agreement, by which the Portland & Ogdensburg's Boston business is to go over the Eastern, and latter company agrees to apply a percentage of its receipts from such business to the purchase of Portland & Ogdensburg bonds.

Dividends.

The following dividends have been declared:

Philadelphia & Reading, 2½ per cent. (quarterly), payable April 24. Books were closed March 31 and will be reopened April 13.

Dubuque & Sioux City, 3 per cent., payable April 15. Books were closed April 1 and will be reopened on the 13th.

Chicago, Rock Island & Pacific, 4 per cent., payable April 27. Books will be closed after April 9.

New York, Providence & Boston (late Stonington), 2½ per cent. (quarterly), payable April 10. Books are closed from the 1st to the 11th.

Delaware, Lackawanna & Western, 2½ per cent. (quarterly), payable April 20. Books are closed till the 21st.

The Delaware, Lackawanna & Western Railroad Company has declared a quarterly dividend of 2½ per cent., payable April 20. Transfer books are closed from March 31 to April 21.

The Dubuque & Sioux City Railroad Company, whose road is leased to the Illinois Central Company, has declared a dividend of 3 per cent., payable April 15.

The Chicago, Rock Island & Pacific Railroad Company has declared a semi-annual dividend of 4 per cent., payable April 27.

The New York, Providence & Boston Railroad Company has declared a quarterly dividend of 2½ per cent., payable April 10.

The Philadelphia & Reading Railroad Company has declared a quarterly dividend of 2½ per cent., payable April 24.

The usual quarterly dividend of 1¾ per cent on the stock of the Berkshire Railroad Company, whose road is leased to the Housatonic Company, is payable April 10.

The usual semi-annual dividend of 3 per cent. on the stock of the Lowell & Lawrence Railroad Company is payable April 6.

The semi-annual dividend of 4 per cent. on the preferred stock of the Ogdensburg and Lake Champlain Railroad Company was paid April 1.

The semi-annual dividend of 3½ per cent. on the preferred stock of the Sioux City & St. Paul Railroad Company was paid April 1.

The Fitchburg Railroad Company, lessee, paid the first quarterly dividend of 1 per cent. on the stock of the Vermont & Massachusetts Railroad Company April 1.

The Pittsburgh, Fort Wayne & Chicago Railroad Company will pay a quarterly dividend of 1¾ per cent. on the guaranteed stock April 7. A quarterly dividend of 1¾ per cent. on the special stock was paid April 1.

A dividend of 3 per cent. on the stock of the East Tennessee, Virginia & Georgia Railroad Company was paid April 1.

The Detroit River Crossing.

At the close of a series of letters to the Detroit *Free Press*, in which he argued in favor of the feasibility of a bridge at Detroit, and its desirability to the city as well as the railroads, Mr. James F. Joy says:

"I have been very careful to say nothing unnecessarily of the future probable course of events. I myself shall soon, and probably within months, pass away as a railroad man. My fellow-citizens, therefore, may now take what I say as the result of my judgment as to the future, but which I shall have no instrumentality in bringing about. The Central road must cross the river by a bridge or a tunnel. A tunnel at Detroit has become impossible. The bed of the river is, at Grosse Isle, solid rock, and the river is only thirty feet deep. A tunnel will be built there from necessity, and all roads will unite in sharing the expense. It can, without great difficulty, be built there, and the necessity is so great that there is likely to be but little delay in the arrangements for it. The city cannot, nor can the State, find fault with the Central Company for the course it must be driven to pursue from a necessity as inevitable as fate. As I have before said, others may contemplate the results and consequences with complacency or satisfaction. All that was in my power to avoid them has been done, and probably this is the last communication which I shall trouble you to insert in your columns upon this subject. I shall have failed in the last but most important of all the means of securing the prosperity of the city, which I have been instrumental to some extent in bringing about, except only the Michigan Central road, heretofore the most important of all, but which also in the probable course of things will be driven to turn the steady current which has been dropping wealth here for near forty years, elsewhere, and by so doing carry with it every other railroad which now connects this city with the country."

Grain Deliveries at New York.

The following are the rules agreed upon between the Produce Exchange committee and the freight agents of the railroads having termini in New York at a conference March 28:

RULE 17. The Grain Committee of the New York Produce Exchange shall appoint an inspector-in-chief, with a deputy for the terminus of each railroad, whose term of office shall be subject to their pleasure. The duties of the inspector shall be to grade the wheat on its arrival, marking the grade on the side of the car in chalk, and keeping a record in a book provided for that purpose of the number of the cars, names of consignees, and the grade of the wheat. For the purpose of facilitating the labors of the inspector, consignees may furnish inspector's certificate from any of the lake ports, which shall be evidence of the grade, and shall be accepted by him without further inspection. All wheat arriving from points where no system of inspection has been adopted shall be graded and inspected, the grades being made to conform as near as practicable to grades known on this market coming from the lake ports. For the inspector's guidance, standard samples shal

be furnished by the Grain Committee. The railroad companies to pay said inspectors for their services.

RULE 18.—The chief inspector shall appoint a deputy or deputies at the terminus of each railroad, whose term of office shall be subject to the pleasure of the Grain Committee. The duties of the said deputies shall be to supervise the weighing of wheat in the cars, on the track scales; to see that the cars are swept clean while unloading, and to keep an accurate record, in a book provided for that purpose, of the weight of the car, loaded and light, its number, the grade of wheat, and the name of the consignee. The railroad companies to pay said deputies for their services.

RULE 19.—For the purpose of facilitating the prompt delivery of wheat afloat on arrival, the railroad companies shall be permitted to put together on boats any wheat of the same grade on the following conditions; 1. That they will keep a record of the weight of the contents of each car, the grade of wheat, and the name of each consignee, and furnish each consignee with a list of the same when the boat is ready for delivery. 2. That they will collect all freight-bills upon track scale weights. 3. That they will guarantee to deliver the quantity as per scale weights, paying promptly for any deficiency, and receiving pay for any excess. 4. All vessel cargoes brought from Buffalo or Erie shall be delivered to the consignees in boat-loads, without inspection, and unmixed with other grain.

Montclair.

The receivers of the New York & Oswego Midland, who have been operating this road, gave notice March 31 that they would cease to operate the road and would pay off the employes in receivers' certificates and discharge them. This notice was rendered necessary by an order issued by the Chancellor of New Jersey in a suit brought by J. H. Pratt and H. C. Spaulding to recover for a portion of the right of way near Bloomfield, N. J., which has not been paid for. Messrs. Pratt and Spaulding, however, state that they notified the receivers through their counsel, that no obstacle would be placed in the way of their continuing to operate road, but they answer that this will not be proper authority. The sale of the road will take place within a few days.

Spartanburg & Asheville.

This company was organized at Charleston, S. C., March 25. The road is to extend from Spartanburg, S. C., northwest to Asheville, N. C., and is intended as a link in the projected new line from Charleston to Chicago.

Atlanta & Richmond Air Line.

An agreement has been prepared and has been assented to by a majority of the bondholders. The bondholders seem disposed to claim their rights and to insist on payment of interest, or foreclosure.

Indianapolis, Bloomington & Western.

The offices of the General Manager, Superintendent, Secretary and Treasurer, Auditor, Superintendent of Telegraph and Assistant Engineer were moved from Urbana, Ill., to Indianapolis, Ind., April 1,

Delaware Shore.

The surveys for this road have been completed from Camden, N. J., to Pennsgrove.

Burlington, Cedar Rapids & Minnesota.

In the suit against this company, mentioned last week, the court has granted a temporary injunction to prevent the issue or transfer of any more stock, pending the trial of the case.

Lafayette, Bloomington & Mississippi.

The Circuit Court having affirmed the validity of the lease to the Toledo, Wabash & Western, an appeal is to be taken to the Supreme Court of Illinois.

Northern Pacific.

As soon as navigation is open the company will put on a line of steamboats from Bismarck to Carroll, a new town at the mouth of the Muscleshell River, there connecting with a stage and wagon line to Helena, Montana. The company expect to re-open the Dakota Division to Bismarck, April 1, and to commence billing freight and ticketing passengers to and from Helena about May 1.

Milwaukee & Northern.

In the bankruptcy suit against this company a jury trial has been ordered by the District Court.

The county board of Shawano County, Wis., has granted the company an extension of time to January 31, 1875, to complete the road to the town of Shawano without forfeiting the county bonus.

Lake Shore & Tuscarawas Valley.

A line has been surveyed for a branch from Beach City, in Stark County, O., southward to Rogersville and southwest to Coshocton. It would be about 35 miles long.

Shenandoah Valley.

There will be a meeting of stockholders April 7, when it is expected that the question of resuming work on the road will be decided.

New York & Oswego Midland.

It is reported that the receivers will shortly ask to be relieved of their trust, giving as a reason the fact that the road cannot earn enough to pay the operating expenses.

Frankford & Breakwater.

The grading of this road is progressing rapidly and track laying has been commenced at Georgetown, Del.

Niagara Suspension Bridge.

The Niagara Falls *Gazette* says that negotiations for the sale of the Suspension Bridge to the Great Western Railway Company have so far progressed that the proposition awaits only the concurrence of the English stockholders.

Mississippi Valley & Ship Island.

The track is laid on this road from Vicksburgh, Miss., southward, 10 miles to Goodrum's and regular trains are running over that section of the road.

Ogdensburg & Lake Champlain.

The Ogdensburg (N. Y.) *Advance* says there is no truth in the report that the suit brought to annul the lease of this road to the Central Vermont has been withdrawn.

Rhinebeck & Connecticut.

Work has been resumed on this road, and a large force is employed.

Mississippi Valley & Western.

The track is laid to Hannibal, Mo., 12 miles south by east from the late terminus at West Quincy and 52 miles from Keokuk. Trains were to begin running through to Hannibal about April 1.

Valley, of Virginia.

The line from Harrisonburg, Va., southwest to Staunton, was opened for business April 1. It is operated by the Baltimore & Ohio Company as an extension of its present line up the Shenandoah Valley, which is now 126 miles long from Harper's Ferry to Staunton. The stations on the new line, with the distances from Harrisonburg, are: Pleasant Valley, 5 miles; Mount Crawford, 8; Meyer's Cave, 13; Mount Sidney, 16; Port Defiance, 18; Verona, 21; Staunton, 26. At Staunton connection is made with the Chesapeake & Ohio.

Work on the line from Staunton to Salem is being pushed forward.

The Virginia Senate has killed the bill authorizing an extension of the road from Salem southwest to Bristol.

Syracuse Northern.

Negotiations between this company and the Rome, Watertown & Ogdensburg are, it is said, at an end. Work will shortly be commenced on the extension of the Syracuse Northern from Sandy Creek northward to Sackett's Harbor.

Winona & St. Peter.

The order abolishing the through rates heretofore given on wheat shipped from points on this road to Chicago has been countermanded and rates will continue as heretofore.

New York & New England.

Substantial improvements are being made in the depot at Boston. A new coal shed has been put up and work is progressing rapidly on an extension of the freight house. The pile bridge over Fort Point Channel has been entirely rebuilt.

Washington & Ohio.

An extension of four miles, from the late terminus at Hamilton, Va., west to Purcellville, has been completed and was opened for business March 31. Work on the line from Purcellville to Winchester is shortly to be commenced.

Detroit, Lansing & Lake Michigan.

The Boston *Advertiser* states that the semi-annual interest on $3,219,000 of 8 per cent. bonds, due April 1, was paid one-half in cash and one-half in preferred stock.

Parker & Karns City.

The track is now laid to Karns City, Pa., 40 miles southwest from Parker. The road will be opened for business April 8. It is of 3-feet gauge.

Lewisburgh Center & Spruce Creek.

This road has been completed and opened for business to Laurelton, Pa., 19 miles west by south from Lewisburg, and eight miles beyond Mifflinburg, the late terminus.

Indianapolis to Detroit.

Through cars were put on April 2, to run from Indianapolis to Detroit, taking the Cleveland, Columbus, Cincinnati & Indianapolis to Muncie, the Fort Wayne, Muncie & Cincinnati to Fort Wayne, and thence the Fort Wayne, Jackson & Saginaw and Michigan Central to Detroit. The distance by this line is 295 miles.

Union Pacific.

Last year this company began the boring of six artesian wells in the arid districts, in order to obtain supplies for locomotives, which had been in part supplied by water trains. The first well is at Separation, 724 miles from Omaha, and the last one is at Rock Springs, 882 miles. Another is in progress at Red Desert. The well at Rock Springs is 1,145 feet deep; the bore is six inches in diameter. In all the wells it was necessary to tube a great part of the way. At Rock Springs the water rises from the depth of 1,145 feet 26 feet above the surface, and discharges 571 gallons per hour, and, at the surface, 960 gallons. At Point of Rocks, 25 miles east, the well is 1,000 feet deep. The water rises only to within 17 feet of the surface, whence it is pumped, but the supply is abundant, and the quality of the water is the best of all the wells. The next well is at Bitter Creek, 21 miles east of Point of Rocks. It is 696 feet deep. It yields, by pumping, 2,160 gallons an hour, and at the surface it flows 1,000 gallons an hour. Next, to the east, is the well at Washakie, 39 miles distant. It is 638 feet deep, and at 15 feet above the surface it flows 800 gallons an hour. At Creston, 14 miles east, the well is 326 feet deep, and an ample supply of water is obtained. At Separation the well is 1,103 feet deep, and water comes within 10 feet of the surface, which by pumping yields 2,000 gallons an hour.

In some of the wells the water has 280 grains of salt in solution, and the incrustation is considerable; but altogether the wells have been a success, and, it is said, the cost of running water trains since the wells have displaced them would have paid for the wells.

Union Pacific Land Grant.

Mr. N. C. Meeker, of Greeley, Col., writes to the New York *Tribune* of this company's land grant as follows:

"This is a good place to speak of the land grant of this road, which has been represented to be of great value. West of Omaha, the grant lies in the Platte Valley for 350 miles, but as much of the land had been previously entered for the first 100 miles, and as the last 100 miles requires irrigation, the amount that can be cultivated is about 100 by 20 miles, that is half of it, for the Government has the other half. Rising from the Platte, by the Lodge Pole Valley, in which runs an insignificant stream, the course is thence to Cheyenne, at an elevation of over 6,000 feet; thence to Laramie Plains, with the elevation increased more than 1,000 feet; and to this point and thence clear through to Ogden, 1,032 miles from Omaha, there are not more than 40,000 acres of tillable land, whether belonging to the Government, to the railroad, or to individuals. The lands are valuable through this whole stretch, with the exception of the Bitter Creek country, for stock purposes, as the grass affords rich feed in both summer and winter. These springs and streams are sufficient for the stock, but not enough for irrigation. Inhospitable as the Bitter Creek country undoubtedly is, and worthless as it seems to be, it yet has no little value on account of the coal with which a large portion is underlaid. Had it not been for this coal, it is doubtful whether trains could have been run, since wood must have been depended upon, and as it is 10 or 20 miles distant, this, with the absence of water, would have been formidable obstacles. It is difficult, therefore, to see any value in the land grant aside from the coal, and this has little use beyond the running of trains, for, as there are few settlements and towns, there can be little commercial demand. Considerable coal, however, is taken to Omaha, a distance of 700 miles, and hitherto the Central Pacific, beginning beyond Ogden, the Salt Lake station, has been supplied from the Evanston mines."

Arkansas Railroad Aid Bonds.

A letter from Gov. Baxter, of Arkansas, is published, in which he says that, upon full investigation, he is satisfied that neither he nor his predecessors had any authority to issue any railroad aid bonds in the name of the State, the provisions of the Constitution not having been regarded in the act of the Legislature authorizing them. The question must, of course, be decided by the courts. The Governor says: "Though the amount of the bonds is large, and the loss to the holders would seem to be serious, it must not be forgotten that, owing to their doubtful validity, and other considerations, they have always been at a very heavy discount, and that their present value in market is nominal. But, if it should transpire that these bonds have any legal validity, they will be paid, although the people have received little consideration for them, and the present holders obtained them at merely nominal prices on a speculative venture."

St. Louis, Keosauqua & St. Paul.

Mr. R. White, the Chief Engineer, writes to us of this road (late the Keosauqua North & South):

"It has been surveyed from Richland, Iowa, to Mexico, Mo. The road is under contract from Keosauqua to Fairfield and partly graded. Iron for 21 miles is purchased and a portion has arrived at Summit Station on the Des Moines Valley Railroad. Tracklaying will be commenced from that place shortly.

The road will pass through a country well settled, where the people are anxious for a southern outlet. The road is intended to be built from Cedar Falls to Mexico. The ends will be leased if favorable terms can be obtained. Estimates on the line surveyed show that it can be graded and bridged for less than $5,000 per mile, with no bad grades or curves. It is intended to begin work in Missouri during the present season. The name of the Keosauqua North & South Railroad in Iowa has lately been changed to agree with the St. Louis, Keosauqua & St. Paul Railroad in Missouri."

Keosauqua is the county seat of Van Buren County, Iowa, is on the Des Moines Valley Railroad about three miles southwest of the Des Moines Valley Road (now Keokuk & Des Moines) at Summit, which latter place is 45 miles northwest of Keokuk. The proposed line is nearly due north and south from Mexico to Cedar Falls, a distance of 230 miles in an air line, through a good country for the most part, but already pretty well provided with railroads.

Atlantic & Lake Erie.

It is reported that at a directors' meeting in Cincinnati, March 26, a contract was closed for the superstructure of the road from New Lexington (on the Cincinnati & Zanesville road, 23 miles southwest of Zanesville) southward to the Columbus & Hocking Valley road at Salina, a distance of about 30 miles.

San Luis Obispo.

A company has been organized and has commenced work on a narrow-gauge railroad nine miles long from San Luis Obispo, Cal., west by south to the steamer landing on the bay of the same name. It is proposed hereafter to extend it southwest some 16 miles into the Santa Maria Valley.

New Jersey Midland.

Holders of $2,500,000 out of $2,750,000 of bonds have assented to the arrangement for funding the coupons proposed by the company.

Gilman, Clinton & Springfield.

In the foreclosure suit brought by the trustees, Thomas A Scott and H. J. Jewett, Morton, Bliss & Co., of New York, who represent holders of a large amount of bonds, have filed a cross-bill, asking to be allowed to come into the suit as defendants. The bill alleges that the trustees are interested to the amount of $400,000 in the Morgan Improvement Company, and that the bondholders do not consider them trustworthy representatives of their interests.

Milwaukee & St. Paul.

The new mortgage for $35,000,000 has been filed and recorded in the various counties through which the road passes. The mortgage is to Russell Sage and Levi P. Morton, trustees, and covers all the company's lines, 1,354 miles.

The lines named are as follows:

Chicago to Minneapolis, by way of Milwaukee and La Crosse	420 miles
Milwaukee to St. Paul, by Prairie du Chien	405 "
Milton Junction to Monroe	42 "
Milwaukee to Portage, by Horicon	95 "
Horicon to Berlin and Winneconne	58 "
Watertown to Madison	37 "
Calmar to Algona	126 "
Conover to Decorah	10 "
Hastings to Glencoe	74 "
Sabula to Marion	87 "
Total	1,354 miles

The new mortgage, which is intended to be the only bonded indebtedness, is thus at the rate of $25,849 per mile, and the annual interest charge will be $2,450,000, or $1,809 per mile.

New York & Harlem.

The mortgage bonds of this company have been put on the free list at the New York Stock Exchange. The mortgage is for $12,000,000 ($88,888 per mile), and is the only funded debt of the company, all the outstanding debt having been funded in these bonds. Under the lease to the New York Central & Hudson River Company, the latter agrees to pay the interest on the bonds and the principal when due. The bonds bear 7 per cent. interest and run to May 1, 1900.

Nashville, Chattanooga & St. Louis.

The first-mortgage bonds have been placed on the free list at the New York Stock Exchange. The official statement makes the main line, Chattanooga, Tenn., by Nashville to Hickman, Ky., 321 miles; branches, to Shelbyville, 9 miles, and to Jasper, 12 miles, making 342 miles of road. The amount of the issue of bonds is $6,800,000, of which $1,200,000 is deposited with the Controller of Tennessee to retire an equal amount of Nashville & Chattanooga bonds endorsed by the State, and $1,000,000 is retained to retire an equal amount of old Nashville & Chattanooga bonds. The mortgage is at the rate of $19,883 per mile, the annual interest charge being $1,363 per mile. The capital stock is $6,486,049.45.

St. Joseph & Denver City.

It is expected that the suit for foreclosure of the mortgage on the Eastern Division will be heard in the United States District Court at Omaha, Neb., early in May, and of both divisions in the same Court at Leavenworth, Kan., in the latter part of the month.

New York & Canada.

A mortgage for $4,000,000 on this road has been put on record. The Union Trust Company of New York is the trustee under the mortgage.

Buffalo & Jamestown.

Negotiations with the Allegheny Valley Company still continue, but no definite result has been reached. Several lines have been surveyed from the present end of the track, but it is understood to be still uncertain what line will be adopted.

Maine Central.

At the annual meeting in Waterville, Me., March 25, the contract with the Eastern Railroad Company was ratified by the nearly unanimous vote of 29,667 to 122 shares. The meeting was largely attended, 30,032 shares, or five-sixths of the whole, being represented. The contract provides for a practical consolidation of the two companies, a division of earnings, and the operation of the roads as one line. It also lays down a basis for a future actual consolidation, in case necessary legislation can be obtained.

Duck River Valley.

The contract for building this road from Columbia, Tenn., to Lewisburg has been awarded to T. K. McCann and M. Nestor, of Nashville, Tenn., work to be commenced within 20 days.

Allegheny Valley—Eastern Extension.

Pittsburgh dispatches announce the laying of the last rail on this line, closing the gap from Summit Tunnel to Benezette, 17 miles. It will probably take some time to ballast and finish up the work. The line, which is the Pennsylvania's "Low-grade Line" through the Alleghenies, extends from the Allegheny Valley road at the mouth of Red Bank, 64 miles above Pittsburgh, northeast 110 miles to the Philadelphia & Erie at Driftwood, 120 miles west of Sunbury.

Berks County.

The track is laid and trains are running to Moselem, 13 miles from Reading, Pa., and three miles beyond Maiden Creek, the late terminus.

The Illinois & Mississippi Canal.

The route of the canal recommended by the Rock Island convention last week was surveyed by Government engineers in the Spring of 1871. The route made Watertown, six miles north of Rock Island City, as the western and Hennepin the eastern terminus, which would be on a nearly due east and west course, and the distance about sixty-four miles. For a feeder a line was also surveyed that would tap Rock River at Dixon, and form a junction thirty-eight miles south near Sheffield. The width of the canal surveyed was to be 132 feet at the bottom and 160 feet on the surface, and seven feet deep. The estimated cost is $12,480,910, exclusive of the right of way. For a commercial canal in connection with the same survey, estimates and places on the same route were made on a scale adopted for commercial purposes only, with a width at the bottom of thirty-six feet, and at the top sixty feet, requiring the same kind of construction on a smaller scale, and making the entire cost $3,899,772. The route is everywhere close to the Chicago, Rock Island & Pacific Railroad. With the Illinois & Michigan Canal it would form a water route about 180 miles long, from Chicago to the Mississippi.

Mexican Interoceanic & International.

The *Two Republics* says: "We are in receipt of the prospectus in relation to the subscription for stock in this company. The invitation of this company to all persons in Mexico to subscribe to stock is a practical one and appeals to the patriotism, pride and public spirit of every citizen or resident. It is practical and proper, because at this time the great financial simoon which so recently passed over the commercial world has so effected capitalists abroad, that there is at this time a great difficulty in procuring pecuniary aid in that direction, making the necessity more imperative that capitalists at home should come forward in this great work."

Pittsburgh, Fort Wayne & Chicago.

The Railway Share Trust Company of London offered between the 13th and 16th of March an issue of $1,000,000 8 per cent. equipment bonds of this company at the price of £195 per $1,000 bond, payable £50 down, £70 April 8 and £75 May 8. Principal and interest are guaranteed by the Pennsylvania Railroad Company. The issue is to replace an equal amount which fell due March 1. They are currency bonds, and at the present rates of gold and exchange the interest is equivalent to about 7.43 per cent. on the price.

Great Western of Canada.

The directors announce that the surplus of income over working expenses for the half year ending with January have been ascertained, and will be sufficient to pay a dividend at the rate of 3½ per cent. per annum, leaving a balance of $3,200. For the corresponding half year of the three years previous the dividend had been at the rate of 6 per cent.; while for 1869 it was 5¼ per cent.; 1868, 5; 1867, 4⅛; 1866, 3½.

Pittsburgh, Wheeling & Kentucky.

It is proposed to issue bonds to furnish means to complete the road. At a conference held recently with the officers of the Pittsburgh, Cincinnati & St. Louis Company, the latter stated that they would be unable to assist in the completion of the road for at least a year to come.

Pueblo & Salt Lake.

Pueblo County, Col, has voted to issue bonds to the amount of $350,000 to secure the construction of this road from Pueblo eastward to the Atchison, Topeka & Santa Fe at Granada, or the Kansas Pacific's Arkansas Valley Branch at West Las Animas.

Lake Erie, Alliance & Wheeling.

A company by this name has filed articles of incorporation with the Secretary of State of Ohio. The road is to be about 130 miles long, from Painesville, O., a little east of south to Bridgeport, opposite Wheeling, W. Va. The capital stock is to be $2,000,000 and the corporators are Hugh Blakely, Samuel Brooks, O. N. Heckman, L. L. Sanborn and Isaac N. Ross.

Robinson's Electric Signal.

The following engraving and description, from the *Iron Age*, are of an apparatus for signaling trains on railroads, equivalent to an automatic block system, which has been invented and patented by Prof. William Robinson, of St. Petersburg, Pa., and has been tested for some months on the Philadelphia & Erie and other railroads:

A represents a section of railroad track which may be a mile or several miles in length, each rail line of which has metallic continuity throughout the length of the section. The section of track *A* is separated from metallic contact with adjacent sections by the wooden joint-blocks *a*, *b*, *c*, *d*. At one end of the section *A* is placed the battery *B*, having its opposite poles connected by the wires *e*, *f*, to the opposite rail lines *C*, *D*. In like manner the relay magnet *R* has its coils connected to the rail lines *C*, *D*, by the wires *g*, *h*; thus there is a complete metallic circuit from the battery *B*, through the wires *e*, *f*, rail lines *C*, *D*, wires *g*, *h*, and the coils of the magnet *R*. The latter thus remains magnetized, keeping the circuit through the battery *E* and signal magnet *S*, closed. The signal magnet *S* thus remaining magnetized, holds the signal banner *F* in a position of concealment with its plane parallel to the track, as shown in the diagram. When, however, a train enters upon the section *A* from either end, or from a siding, the wheels and axles bridge over between the rail lines *C*, *D*, and, by reason of their mass and consequent superior conductivity, they short-circuit the current from the rail battery *B*; the current, thus intercepted, forsakes the small wire of the magnet *R*, which, being thus demagnetized, releases its armature and opens the circuit of the battery *E* and signal magnet *S*. The latter, releasing its armature, the spring *I* swings the armature lever *H* in a horizontal plane. The lever *H* gears into a slotted crank *K*, which is fixed to the vertical shaft *L*, which latter carries the banner bearing cross arm *M*. Thus, when the spring *I* acts upon the lever *H*, the shaft *L* is thereby turned one-fourth around, the cross-arm *M* describes an angle of 90 degrees in a horizontal plane, and the banner *F* is thereby swung in front of the orifice *G* of the signal-house, covering the same. Thus the signal remains exposed, while a train or a car remains on the section *A*. As soon, however, as the section is cleared, the magnet *R* is instantly remagnetized, the signal circuit closed, and the banner withdrawn to the position shown.

Incidentally this signal is a broken rail detector. If one of the rail lines, *C*, *D*, is broken by the tearing up or breaking of a rail or disconnecting of a joint, the rail circuit to the magnet, *B*, is interrupted, the current from the rail battery grounded, and the magnet, *R*, demagnetized, and signal exposed, as already explained. The signal may also be operated from any office within the section, either by disconnecting one of the battery wires, *e*, *f*, or by connecting two wires from the rails, *C*, *D*, by means of a key. It is also operated by turning any switch which happens to be within the section. When desired, one or more secondary signals, thrown either forward or back of the primary signal, are operated. In this case a single line wire is used, which is connected to the third local post, *i*, of the relay, and to the primary signal, in such a manner that it is impossible for the secondary signal to be shown unless the primary signal is first exposed. The primary signal battery, *E*, is used to operate the secondary signals, whether audible or visual.

The Master Mechanics' Association—Circulars of Inquiry—Mechanical Laboratory.

The Committee appointed at the last meeting of the American Railway Master Mechanics' Association on the subject of the establishment of a mechanical laboratory beg the consideration of the members of the Association to this important matter, and request the opinion of each as to the nature of the requirements of a mechanical laboratory for the general benefit of the Association, in the form of answers to the following inquiries:

1st. Should such a laboratory comprise apparatus for the solution of mechanical questions only, or for chemical also?

2d. What mechanical apparatus, in addition to a train dynamometer, do you consider, should form a portion of the property of such a laboratory? Give list of instruments.

3d. What chemical apparatus, do you consider, should be possessed? Give a list of the same.

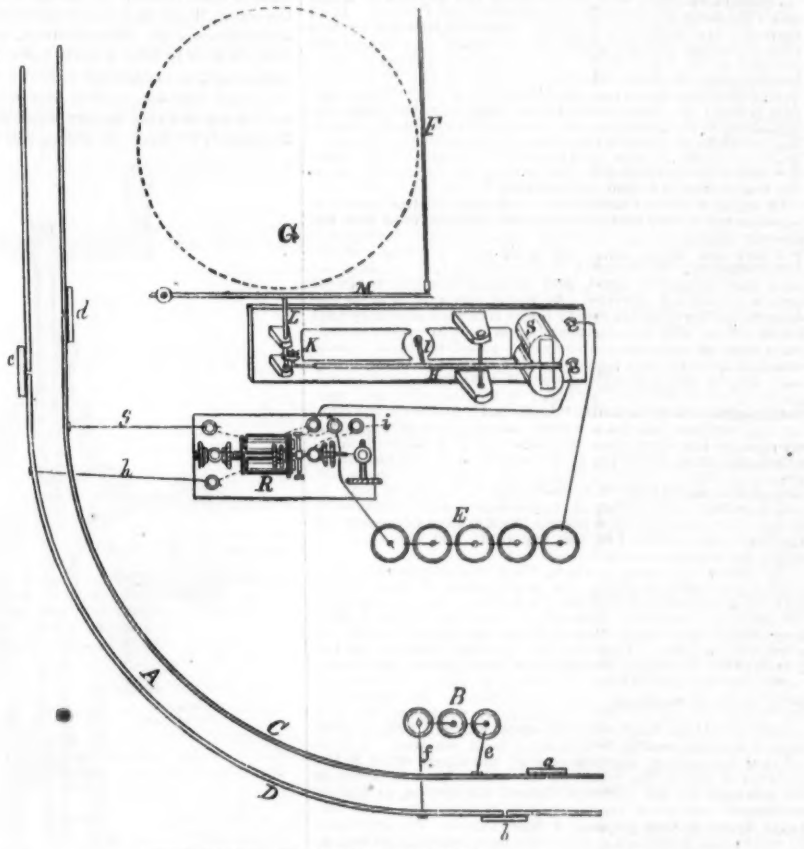
4th. Should the laboratory be open at all times for the reception of inquiries from any member of the Association, or only on special occasions for use of committees, on some certain form of application to be adopted?

5th. In what city, do you consider, the establishment of the laboratory would render the greatest benefit to members of the Association generally?

Yours faithfully,

W. A. ROBINSON,
Great Western Railway, of Canada.
R. WELLS,
Jeffersonville, Madison & Indianapolis.
J. M. BOON,
Pittsburgh, Fort Wayne & Chicago.
N. E. CHAPMAN,
Cleveland & Pittsburgh.
H. M. BRITTON,
Whitewater Valley. Committee.

Please address replies not later than 15th April next to W. A. Robinson, Mechanical Superintendent, Great Western Railway of Canada, Hamilton, Ontario.



ROBINSON'S ELECTRIC SIGNAL.

HEADQUARTERS OF CONVENTION.

The undersigned Committee, appointed by the American Railway Master Mechanics' Association to make arrangements for holding the seventh annual convention, to be held in Chicago, May 12, 1874, would respectfully inform the members that they have made the necessary arrangements, and that suitable accommodations have been procured at the Sherman House for all members of the Association.

It is desirable that all members wishing to attend will, as soon as possible, forward their names to the Chairman of the Committee, stating whether they will be accompanied by ladies, and what accommodations will be required.

It is important that the Committee have this information on or before May 5.

Respectfully,

S. J. HAYS,
H. ANDERSON,
C. C. ELLIOT, } Committee.

Please address S. J. Hays, Superintendent of Machinery, Illinois Central Railroad, Chicago.

APPEAL FOR THE CO-OPERATION OF RAILROAD MANAGERS.

To the Presidents and Superintendents of the Railways in America:

GENTLEMEN: We respectfully solicit your attention to the objects and purposes of our organization, established in September, 1868, under a constitution which limits the membership exclusively to persons having charge of the motive power of railways, as superintendents of machinery, master mechanics or foremen. Our earnest desire is to make this Association a means of diffusing among railway managers comprehensive knowledge of the mechanical arts, as applied to the construction and operation of railway machinery.

To accomplish this, annual meetings are held, and appropriate committees appointed, whose duty it is to gather from all parts of the country the ideas, practice and experience of manufacturers and mechanics, to carefully examine and digest them, and present to the Association elaborate reports thereon. In this manner a valuable fund of information will be accumulated for the professional guidance and benefit of railway officials, motive power departments will be managed with increased efficiency and economy, railway corporations will be directly benefited, and great advantage will accrue to the traveling public.

Nearly one-half the cost of operating railways is expended in the mechanical departments, and that which tends to perfect the conduct of this branch of the service will materially lessen operative expenses.

Eminent railway mechanics entertain diverse opinions regarding important details of construction of locomotive engines, regarding the correct proportions of various parts; the strongest and simplest mode of building and bracing locomotive boilers, to insure them against explosion; the most efficient form and construction of fire-boxes, to develop the value of the different kind and qualities of fuel; the relative value of iron and steel plates for boilers, and especially of copper, iron and steel, for furnaces and flues; the relative safety and economy of iron and steel tires, axles, crank-pins and truck wheels; the causes and preventives of boiler explosions; and a multitude of kindred topics, embracing a wide range and thorough knowledge of the arts and sciences, as applied to the details of manufacture and management of the locomotive engine.

These diverse opinions we seek to harmonize by interchange of thought, and systematic investigation of views presented and opinions expressed. The solutions of the various questions will be placed in the hands of competent mechanics, and from the experience and practice in our branch of the service, gathered from all portions of the country, we hope to deduce conclusions that will form a basis for future guidance and action.

Our Association is not framed from motives of personal aggrandizement, not for the advancement of self-interests, or to further selfish ends; but we, as earnest workers for the greater development of the mechanical arts in this the "iron age," seek through our organization a broader and deeper knowledge than we have to-day.

With these ends in view, we request your co-operation and aid in our important undertaking. Our interests are identical with yours, and while we feel dependent, to a great extent, upon you, gentlemen, for the success of our enterprise, we believe that this identity of interest will insure your support. You look to us for knowledge in our branch of the service, and expect mechanical skill and ability in the performance of our duties; that we may be able to fill the measure of our desires and your expectations, we solicit your powerful influence in promoting the welfare of our society.

With your aid and our earnest endeavors, success is insured. We beg leave to suggest that you call the attention of your Master Mechanic to the importance of attending our annual conventions, and aid in effecting the objects of the Association; and also that you place their names upon your exchange list for annual passes.

We shall at all times be happy to receive from you such counsel and suggestions as you may deem promotive of the welfare of our organization.

We remain, gentlemen, very respectfully yours,

H. M. BRITTON, President,
N. E. CHAPMAN, 1st Vice-President,
W. A. ROBINSON, 2d Vice-President,
J. H. SETCHELL, Secretary,
Supervisory Committee.

The Block System on the London and Southwestern.

The London *Times* gives the following account of the working of the block system on a crowded track:

To illustrate the working of the block system clearly, it will be best to give the following example of actual practice. The observations upon which it is based were made at Southampton and Bishopstoke and the intermediate signalling stations. The distance between the above-named places is five miles, and the intervening space is divided up into seven sections, each of the first four being about 400 yards, and the last three about a mile and a half in length. The shortness of the sections is necessary here in consequence of the exceptionally heavy traffic passing over the line, as well on account of numerous sidings and of the Dorchester Branch, which is connected with the main line at two points. Omitting for the sake of clearness all the intermediate signal-boxes save one, let it be assumed that the observer is stationed in that one—say the Northam Junction, which is situate between Southampton and Bishopstoke. The first indication received by the signalman at the junction that a train is approaching him from Southampton is the warning signal, which is given on the bell by the signalman at the signal-box next below him between the junction and Southampton, and which indicates that the train has entered the section under the control of the intermediate man. This signal implies "train coming; look out," and it enables the signalman at the junction to see that the line is